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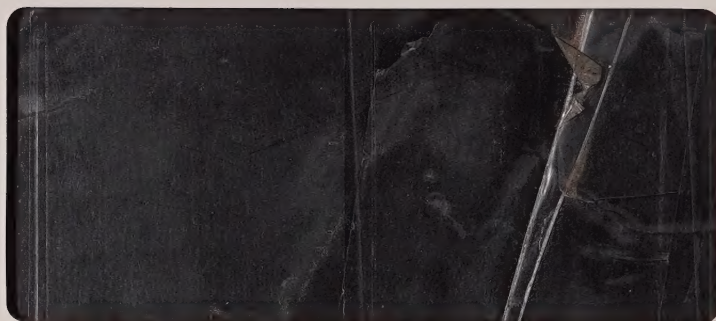
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SYNC SOURCE 1303

MULTIRATE TV
SYNC GENERATOR ACCESSORY

instruction manual



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SYNC SOURCE 1303
MULTIRATE TV
SYNC GENERATOR ACCESSORY

Series F
Instruction Manual
February, 1978

Serial No. _____

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VISUAL INFORMATION INSTITUTE, INC.
Box 33 / Xenia, Ohio 45385 / Phone (513) 376-4361

NOTICE

This manual is prepared on the premise that the user is familiar with television system terms and concepts, and particularly is acquainted with the use of electronic test instruments (such as an oscilloscope) to interpret television waveforms and to relate the content of such waveforms to the pattern which would be produced on a typical television display device. If this is not the case, background reference material is suggested as follows:

1. Glasford, Glenn M., Fundamentals of Television Engineering (New York, NY: McGraw-Hill Book Company, Inc., 1955).
2. Showalter, Leonard C., Closed-Circuit TV for Engineers and Technicians (Indianapolis, Indiana: Howard W. Sams & Co., 1969).
3. Hansen, Gerald L., Introduction to Solid-State Television Systems (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1969).
4. Fink, Donald G. (Ed.), Television Engineering Handbook (New York, NY: McGraw-Hill Book Company, Inc., 1957).

Please contact Visual Information Institute if additional information is desired on television tests and measurements or about application of this instrument. (Phone: 513-376-4361)

You must read the instruction manual completely before connecting the Signal Source Generator for operation. Observance of only a few procedures will provide greater operator convenience, and will assure most effective application of the equipment as well as provide maximum safety to the user.

CAUTION

Even low voltages commonly present in transistorized circuits are potentially dangerous. Additionally, full line voltage is present on fuse terminals, power switch terminals, and other exposed points within the interior of the unit, and are accessible when the cover of the equipment is removed. Caution should be exercised, as follows:

Remove power by unplugging the line cord when removing covers and inspecting interior of the unit.

Observe the common safety practices when servicing equipment (dry skin, insulation of the body from ground, etc.).

Never work on electrical equipment when alone.

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INTRODUCTION

This instruction manual contains all essential information for the proper connection and use of the Signal Source CCTV Generators; the manual contains maintenance information as well.

This device contains circuits which are considered proprietary. Duplication of Signal Source equipment is not authorized without the expressed, written consent of Visual Information Institute, Inc. These instruments, as described in this manual, are manufactured under U. S. Patent No. 3,483,479, plus other domestic and foreign patents pending.

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- a. Remove power by unplugging the line cord when removing covers and inspecting interior of the unit.
- b. Observe the common safety practices when servicing equipment (dry skin, insulation of the body from ground, etc.).
- c. Never work on electrical equipment when alone.

APPLICATIONS

Sync Source generators develop precise synchronizing pulses for exact and effective synchronization of closed circuit television devices, including test pattern generators, cameras, display devices, etc. This particular generator, Sync Source 1303, provides synchronizing waveforms as specified by Electronic Industries Association Standards RS-170, RS-330 and RS-343. In

addition to H Drive, V Drive and Mixed Blanking, this unit generates a Composite Sync signal which includes front porch delays in the vertical and horizontal sync plus optional serrations and equalizing pulses in the vertical interval which are selectable by front panel control.

This instrument is useable at any one scanning rate, including "standard" 525, 675, 729, 875, 945, 1023, 1029 and 1225/60 Hz field rates and 625/50 Hz field rate, all 2:1 interlace; other "non-standard" line numbers may be employed by special interconnection and use of the proper master oscillator frequency according to factory instructions. The scan rate selector position marked "SPECIAL" provides the 729/60 scan rate unless otherwise specified by customer order. All proportions of the horizontal rate waveforms are adjustable by potentiometer control, permitting exact matching of this unit to other existing equipment, allowing test of apparatus under realistic operational conditions. Vertical proportions of Blanking, Drive and Sync are counted from the horizontal rate.

The synchronizing generator provides a BROADCAST format composite Sync signal which includes front porch delays in the vertical and horizontal sync and serrations and equalizing pulses in the vertical sync interval. Format selection switch provides either the BROADCAST format, an INDUSTRIAL sync waveform without equalizing pulses and serrations, or a MILITARY waveform which has no horizontal front porch or h-rate pulses in the V sync front porch interval. The generator normally develops an interlaced (2:1) television raster; non-interlace (1:1) condition can be developed by special interconnection. Refer to OPTIONS IN OPERATION for further information on available modifications.

Change of scan rate and pulse format is readily accomplished in this generator as explained in detail in the SCAN RATE CHANGE AND SYNC FORMAT section.

TECHNICAL SPECIFICATIONS

SCOPE

This specification defines the electrical and mechanical characteristics of a unit which develops precise pulses as required to properly synchronize television cameras, display devices, special effect generators, etc. It is designed to provide waveforms as detailed by EIA Standards RS-170, RS-330 and RS-343. Adjustment is provided for all horizontal (h-rate) pulses. This permits operation at either the nominal value or anywhere within the tolerance region set forth by standards. Scan rate is selected automatically by front panel control.

ELECTRICAL CHARACTERISTICS

- Functions - Development of precise signals for 2:1 interlaced television synchronizing.
- Output Signals - One each of the following pulses:
- Type - H Drive, V Drive, Blanking, Sync
 - Level - 4v. peak
 - Polarity - Negative going pulses
 - Impedance - 75 ohm source termination
 - Risetime - Nominally 0.1 usec.
 - Coupling - A.C. (Capacitive)
- Input Signal Requirements - None
- Controls - External -
- Scan Rate Selection
 - Sync Waveform Format
- Internal -
- H Front Porch
 - H Sync Width
 - H Blanking Width
 - H Drive Width
 - 2H Serration Width
 - 2H Equalizing Pulse Width
 - Pulse Amplitude
- Scan Rates - Any one rate, 2:1 interlace, as selected by front panel switch:
- | | | | |
|--------|--------|---------|------------------|
| 525/60 | 875/60 | 1023/60 | 1225/60 |
| 625/50 | 945/60 | 1029/60 | Special (729/60) |
- Other "non-standard" rates can be provided to customer specification at 2:1 interlace or 1:1 non-interlace ratios.

Waveform - Front panel selection of Industrial, Military, or Broadcast type waveform, including 2H Equalizing Pulses and Serrations where appropriate, in accordance with EIA Standards RS-170, RS-330 and RS-343.

Power Requirement - D.C. voltages from parent unit, at the following nominal current values.

+5v. @ 700 ma	+12v. @ 63 ma
-5v. @ 58 ma	+D.C. unregulated @ 4.5 m

MECHANICAL CHARACTERISTICS

Enclosure - Custom package for accessory installation in appropriate Signal Source CCTV Test instruments.

Weight - Approx. 4 lbs.

Operating Temperature Range - 0°C to +50°C.

NOTE: In the interest of product improvement, these specifications are subject to change without notice.

MODIFICATIONS

This section contains a description of modifications or changes to instruments to conform to a particular customer's request or to correct documentation to include late revisions in circuitry configuration or components included to improve performance of the instrument.

INSTALLATION

Sync Source Accessory CCTV Sync Generators are supplied from the factory mounted inside the CCTV Test Instrument cabinet. Observe the instructions for installation of the parent unit prior to initial operation.

CONNECTIONS

Accessory units provide output pulses at the generator cabinet rear panel. The BNC cable connectors are marked as to function.

Outputs should be terminated properly to assure best pulse shape, without ringing or reflections. If the sync generator outputs are also used elsewhere, coaxial cable should be used to connect sync generator outputs (H Drive, V Drive, Blanking and Sync) to their point of utilization. All outputs are source terminated to drive 75 ohm coaxial cable such as RG-11/U or RG-59B/U.

All sync generator waveforms as used in pattern development are presented at front panel for reference, whether from internal or external source.

If the sync generator accessory is included, the instrument serial number will identify the type of accessory by option letter, for instance Signal Source 1203D. A separate instruction manual is provided for the accessory.

OPERATION

The Sync Source is ready to operate once power and signal connections are complete. Although the instrument was carefully calibrated at the factory prior to shipment, it is suggested that calibration be checked in accordance with the procedure outlined in this manual prior to initial operation.

OPTIONS IN OPERATION

Many operating modes are possible in this instrument in addition to those selected as "standard" to comply with most application requirements. Following is a summary of some other options which may be of interest. Many other operating conditions are possible. Please contact the factory for detailed information on implementation of these or other variations in operation.

1:1 INTERLACE (NON-INTERLACE)

While the "normal" television system operates at 2:1 interlace, some applications require no interlace (sometimes referred to as 1:1 interlace). This instrument can be configured, by harness wiring change, for 1:1 interlace operation on any scan rates, as desired. Caution is necessary in describing the rate desired, as discussed fully on page 11. This is a factory installed modification. Note that if a rate is changed to 1:1 interlace, this removes capability for 2:1 interlace operation for that rate.

PULSE WIDTH MODE

The instrument normally is provided with two pulse width modes. The low range "wide" mode normally is used for calibration of the 525/60 and 625/50 scan rates. The high range "narrow" mode is used for all other scan rates, as EIA Standard RS-343 requires the same synchronizing generator pulse widths for rates at above 525/60. Wiring can be modified to provide either mode on any scan rate, and calibration for each mode can be tailored to pulse widths as desired. Note that there is provision for two modes only. This is a factory installed modification.

OUTPUT COUPLING

Sync generator output pulses are provided at polarity, impedance, and levels as described by EIA Standards. There is no standard for direct coupling of sync generator output pulses, and therefore all outputs are a.c. coupled, unless otherwise specified, to prevent mismatch with other t.v. system equipment. Output pulses can be provided direct-coupled, but extensive modification is required. The customer must specify precisely the d.c. levels desired in the output signal. This is a factory installed modification.

OUTPUT SIGNALS

The synchronizing ("sync") generator produces pulses which are used to synchronize camera, display, and other television devices in developing the t.v. raster. These pulses control the order in which the television picture will be produced. Four basic types of electrical pulse signals have become commonly used for such purposes, including H Drive, V Drive, Blanking and Sync, as described by EIA Standards RS-170, RS-330 and RS-343. All pulses are generated from a very stable master oscillator which is either crystal controlled or accurately phase referenced to the power frequency; "Line Lock" is used to minimize the visibility of power line hum which may be introduced in television signal processing and distribution. Digital techniques are used to generate pulses at the horizontal and vertical rates of the scan rate to be used. These include:

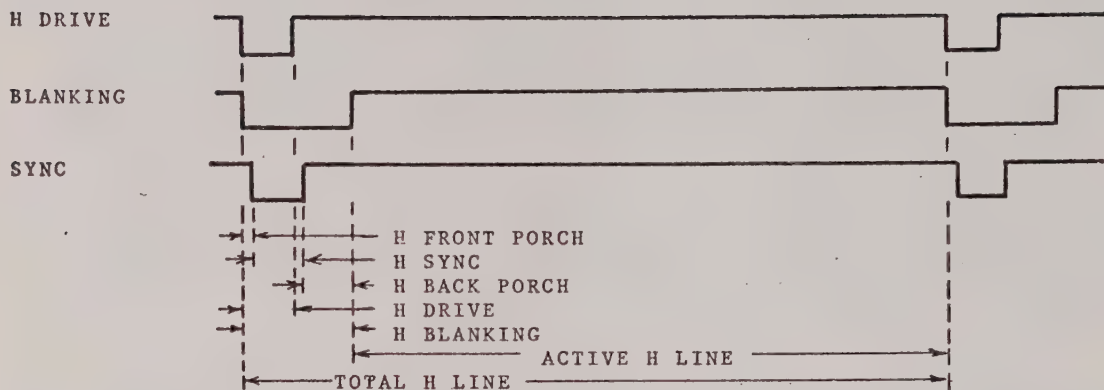
H DRIVE is a pulse train in which a pulse starts at the end of every television scanning line. Its function is to mark the time interval between the end of one line and the start of another; the pulses may be used to control horizontal deflection "flyback" and signal processing. The pulse train is continuous, uninterrupted even during the vertical synchronizing interval. These pulses are useful for synchronizing an oscilloscope when inspecting the television waveform at horizontal line rate.

V DRIVE is a pulse train in which a pulse starts at the end of each television field. Its function is to mark the time interval between the end of one television field and the next; these pulses may be used to control vertical deflection "flyback" and signal processing. These pulses are useful for synchronizing an oscilloscope when inspecting the television waveform at vertical field rate.

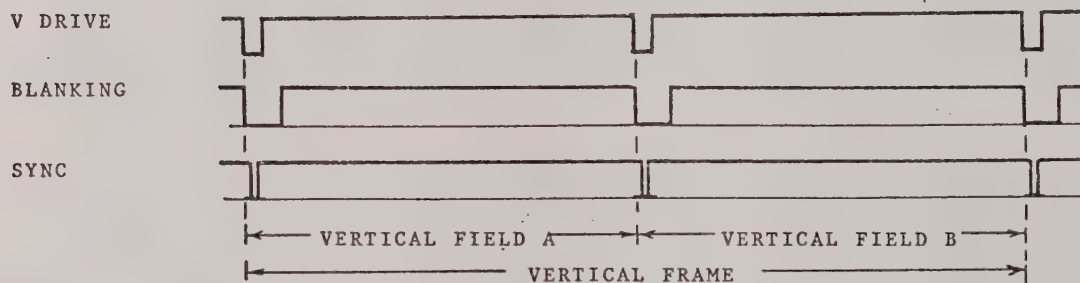
BLANKING is a mixture of horizontal and vertical information intended to control the "blackout" of the television system during deflection return between horizontal lines and vertical fields. These pulses are wider than Drives or Sync to insure that all transitions are made invisible.

SYNC is a complex combination of horizontal and vertical pulse information intended to control the decoding of a television signal by a display device, recorder, or other type of video processing equipment. Usually it is mixed with the video information to produce a Composite Picture Signal which is distributed for general use.

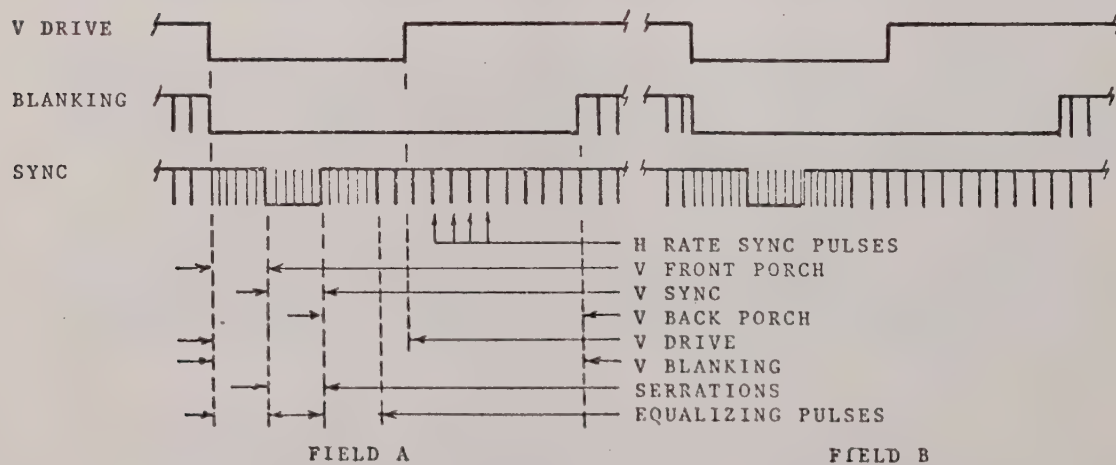
The description of a scan rate will specify the number of scanning lines per frame and the vertical field rate. Most television systems are "interlaced" to avoid a visible flicker in the display, usually at 2:1 ratio. Thus 2:1 interlace ratio means



a. WAVEFORMS AT HORIZONTAL RATE



b. WAVEFORMS AT VERTICAL RATE



c. EXPANDED VIEW, DETAIL OF VERTICAL INTERVAL WAVEFORMS

Figure 1 - Typical Sync Generator Output Waveforms

that two entire display "fields" must be developed to generate one "frame", or complete image. For example, the most common rate of 525/60 indicates that:

- There are 525 scanning lines per television frame.
- The field rate is 60 Hz. That is, one television field is developed in 1/60 second.
- Unless specified otherwise, it is assumed that the interlace ratio is 2:1. That is, the frame, a complete image, will be composed of two fields. Therefore, one frame is produced in 1/30 second. Each field will be composed of half the number of scanning lines per frame, in this example 262.5.

Scan rates in common use at this time for monochrome systems include 525/60, 625/50, 729/60, 875/60, 945/60, 1023/60, 1029/60, and 1225/60. The standard NTSC color system operates at the 525/60 rate with a phase-locked subcarrier at 3.579545 MHz (+ 20 Hz). This results in an actual vertical field rate of 59.94 Hz.

The format of H Drive, V Drive and Blanking is the same for all rates. The Sync waveform can occur in any one of three formats, according to application requirements:

BROADCAST-type sync with 2H rate Equalizing Pulses for three Scanning line intervals (6 pulses) before and after the vertical sync interval, 2H rate Serrations during the three-line vertical sync interval (6 pulses), and horizontal front porch as specified in EIA Standard RS-170 and shown as optional in EIA Standards RS-330A and RS-343A.

INDUSTRIAL-type sync the same as above, without Equalizing Pulses and Serrations, per EIA Standards RS-330A and RS-343A.

MILITARY-type sync which does not include Equalizing Pulses or Serrations, has no horizontal front porch, and no horizontal rate pulse information during the vertical front porch of three scan line duration.

Horizontal rate pulses are adjustable so the waveform can be matched exactly to the desired operating format. Vertical pulse proportions must be synchronous with the horizontal scan lines, and therefore are determined by digital count, adjustable by count selection.

BLANKING

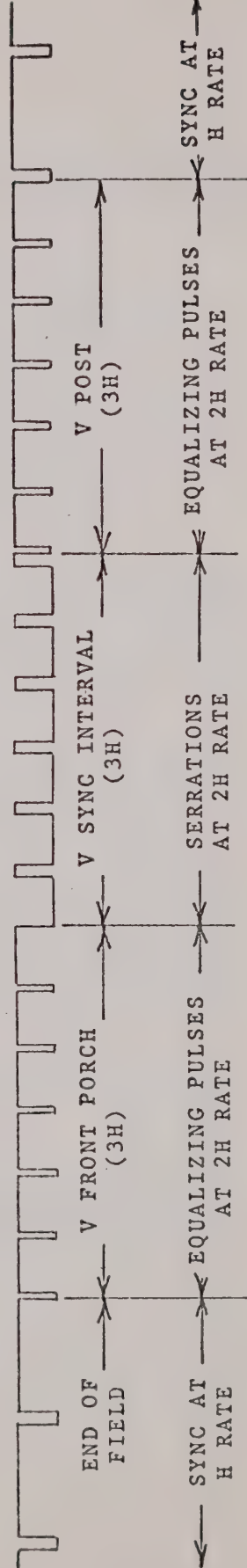
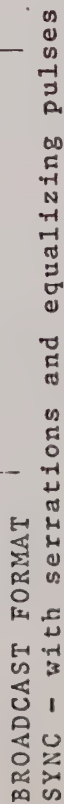
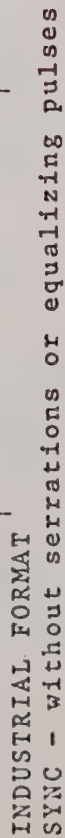
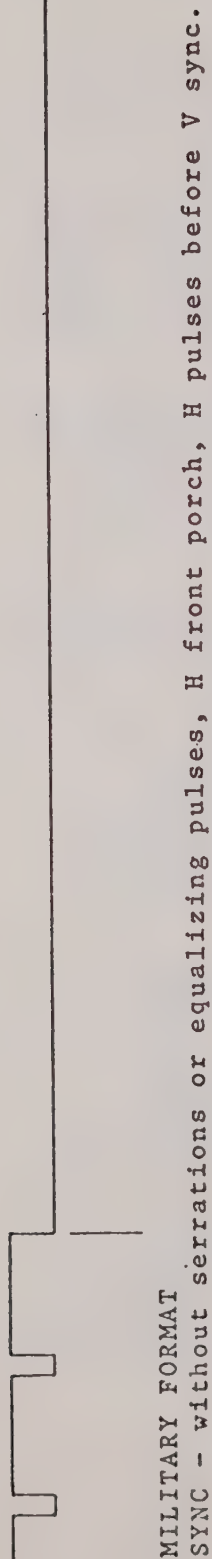


Figure 2 - Detail of Vertical Sync Interval

Television operation at so-called 1:1 interlace, or non-interlace, is becoming more prevalent. Care must be taken in describing such operation to avoid confusion. As noted, two "fields" make a "frame" in the commonly used 2:1 interlace systems.

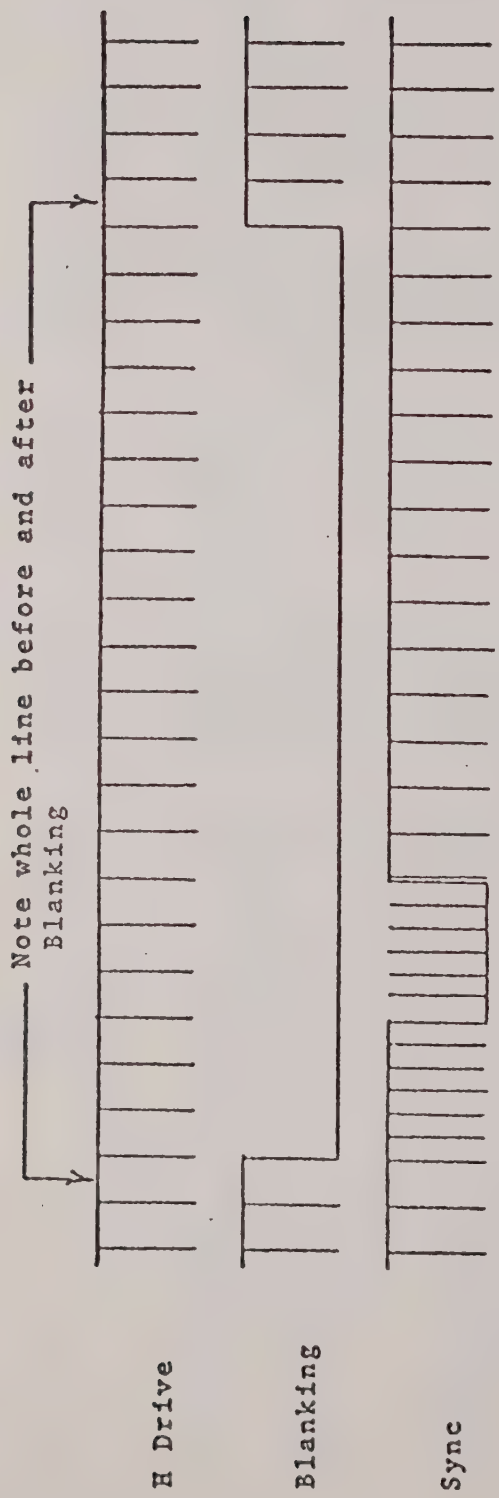
This practice has carried over in description of 1:1 interlace in some cases, specifications assuming two identical fields per frame. In other cases, it is assumed that, since fields are identical, one "field" makes a "frame".

To clarify specification of scan rates, it is assumed that the number of scan lines necessary to develop a complete image make a "frame". Thus a 1:1 interlace (or non-interlace) system will have one "field" per "frame". The 2:1 interlace system will have two "fields" per "frame". For example:

SCAN RATE	SCAN LINES PER FRAME	SCAN LINES PER FIELD	FIELD RATE	FRAME RATE
525/60/2:1 interlace	525	262.5	60 Hz	30 Hz
525/60/1:1 interlace	525	525	60 Hz	60 Hz

There must be a whole number of scanning lines in each field for 1:1 interlace, whereas to obtain 2:1 interlace each field must have a half line. For example, often it is desired to develop a non-interlace condition for the common 525/60/2:1 interlace system. This may be done by adding a one-half line to the field, resulting in:

	SCAN LINES PER FRAME	SCAN LINES PER FIELD	FIELD RATE	FRAME RATE
ORIGINAL SYSTEM				
525/60, 2:1 interlace	525	262.5	60 Hz	30 Hz
MODIFIED SYSTEM	526?	263	59.88 Hz	29.44 Hz?
(1:1 interlace)	(263)			(59.88)



a. Start of "Even" television field

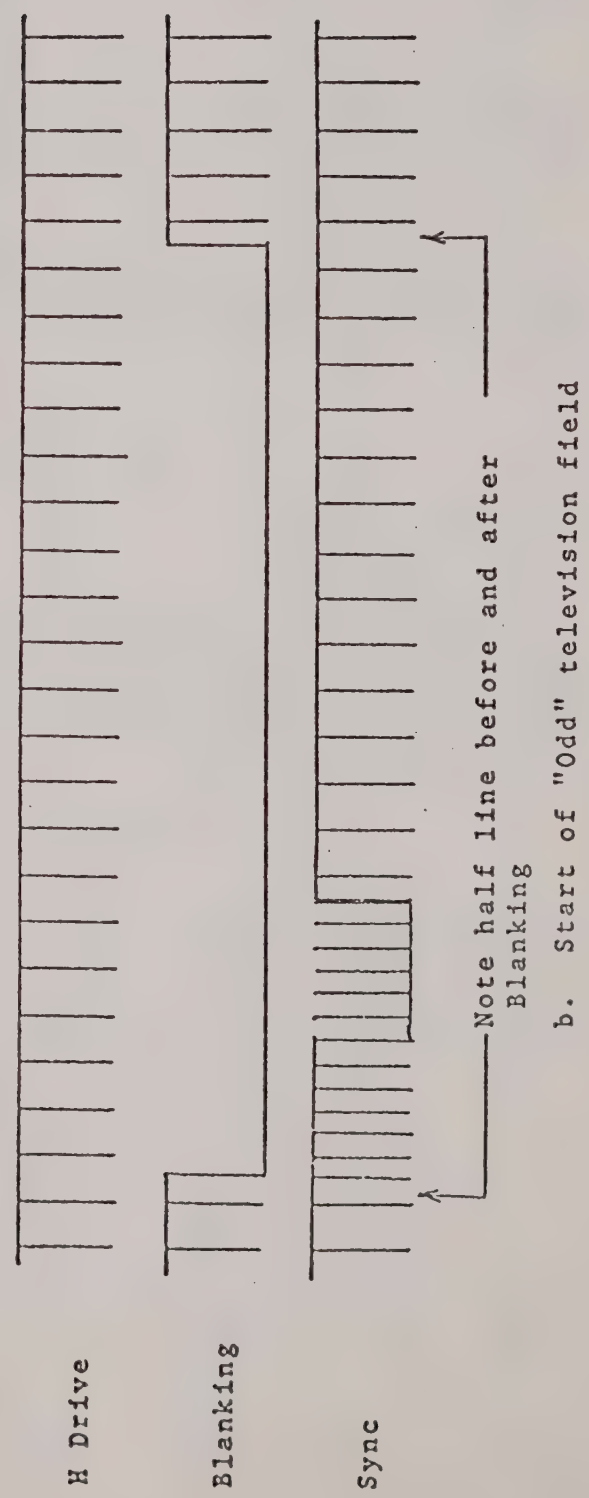


Figure 3 - Detail of 2:1 Interlace

TABLE I

SYNC GENERATOR CHARACTERISTICS - 2:1 INTERLACE

Rate -	525	675	729	875	945	1023	1029	1225	625
Lines per Frame	262.5	337.5	364.5	437.5	472.5	511.5	514.5	612.5	312.5
Lines per Field	60	60	60	60	60	60	60	60	50
Field Rate	315.00	405.00	437.40	525.00	567.00	613.80	617.40	735.00	312.50
20H Master Osc - kHz	15.750	20.250	21.870	26.250	28.350	30.690	30.870	36.750	15.625
H Rep Rate - kHz	63.4	49.4	45.7	38.0	35.3	32.6	32.4	27.2	64.0
Total H Line - usec	52.4	42.4	38.7	31.0	28.3	25.6	25.4	20.2	53.0
Active H Line - usec									
Typical Pulse Widths									
V Drive	10.5	13.5	14.5	17.5	18.5	20.5	20.5	24.5	10.5
V Front Porch	3	3	3	3	3	3	3	3	3
V Sync	3	3	3	3	3	3	3	3	3
V Post	3	3	3	3	3	3	3	3	3
V Blanking	20	26	28	33	36	39	39	46	20
H Blanking	11.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	11.0
H Drive	6.4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	6.4
H Front Porch	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5
H Sync	4.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	4.75
2H Equalizing	2.35	1.4	1.4	1.4	1.4	1.4	1.4	1.4	2.35
2H Serrations	4.50	2.0	2.0	2.0	2.0	2.0	2.0	2.0	4.50

NOTE: Pulse Widths and rates conform to applicable EIA Standards RS-170, RS-330, RS-343, RS-375.

V Blanking nominal pulse width = 1250 usec at all rates.

V Drive nominal pulse width = 667 usec at all rates.

Note that the confusion in terminology arises in description of scan lines per frame and frame rate, possibly in violation of "standard" convention.

Horizontal rate pulses are adjustable so the waveform can be matched exactly to the desired operating format. Vertical pulse proportions must be synchronous with the horizontal scan lines, and therefore are determined by digital count, adjustable by count selection.

CIRCUIT CARD AND CONTROL LOCATIONS

CABINET LAYOUT

This instrument is packaged in a laboratory cabinet suitable for bench or rack mount use. It can contain two or three card files, including from 44 to 66 circuit cards, 22 per section. Text description is based upon orientation as outlined below.

In some instruments, Section A is used for optional accessories only and may not be included if options are not installed. This provides as small a cabinet as possible for all configurations.

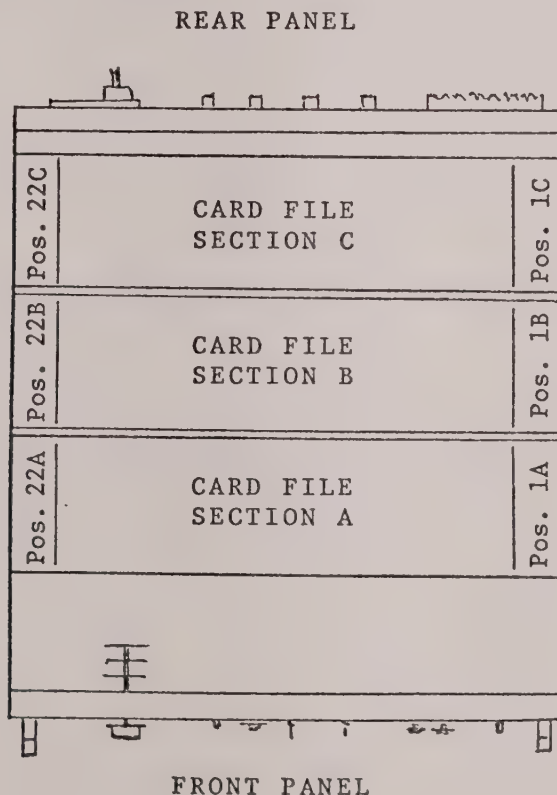


FIGURE 4 - Top View of Instrument

CIRCUIT CARD LOCATIONS

Circuit cards in the Sync Source 1303 accessory are located in the positions listed below. The sync generator package is installed in the circuit card file immediately behind the front panel of the parent unit (Section A). Remove the generator top cover for access to internal controls.

Insertion of cards into the improper slot may cause damage and, of course, the generator will be inoperative. Be sure to reinsert circuit cards into the correct location if they are removed, and establish that they are firmly seated into the connector. Cards are keyed so they cannot be inserted backwards; an attempt to force them in the wrong way will result in a broken connector.

SECTION A (FRONT)

<u>Pos.</u>	<u>Dwg. No.</u>	<u>Group</u>	<u>Name</u>
11A	L-2003	1	Pulse Output
12A	L-2038	0	Multirate V Sync
13A	L-2036	1	Dual Mono-H Front Porch & H Sync
14A	L-2036	2	Dual Mono-2H Equalizing & 2H Serrations
15A	L-2036	3	Dual Mono-H Drive & H Blanking
16A	L-2035	6	Multirate Blank/Control
17A	L-2034	0	Multirate Crystal
18A	L-2039	0	Multirate Count
19A	L-2037	1	Multirate Count Select 1
20A	L-2037	2	Multirate Count Select 2
21A	L-2037	3	Multirate Count Select 2

INTERNAL CONTROL LOCATIONS

The circuit cards may vary in orientation for various instruments. Therefore, the description of control locations has been standardized as to location on the circuit card itself.

Locations are keyed to the circuit card as viewed from component side, connectors down, as shown below:

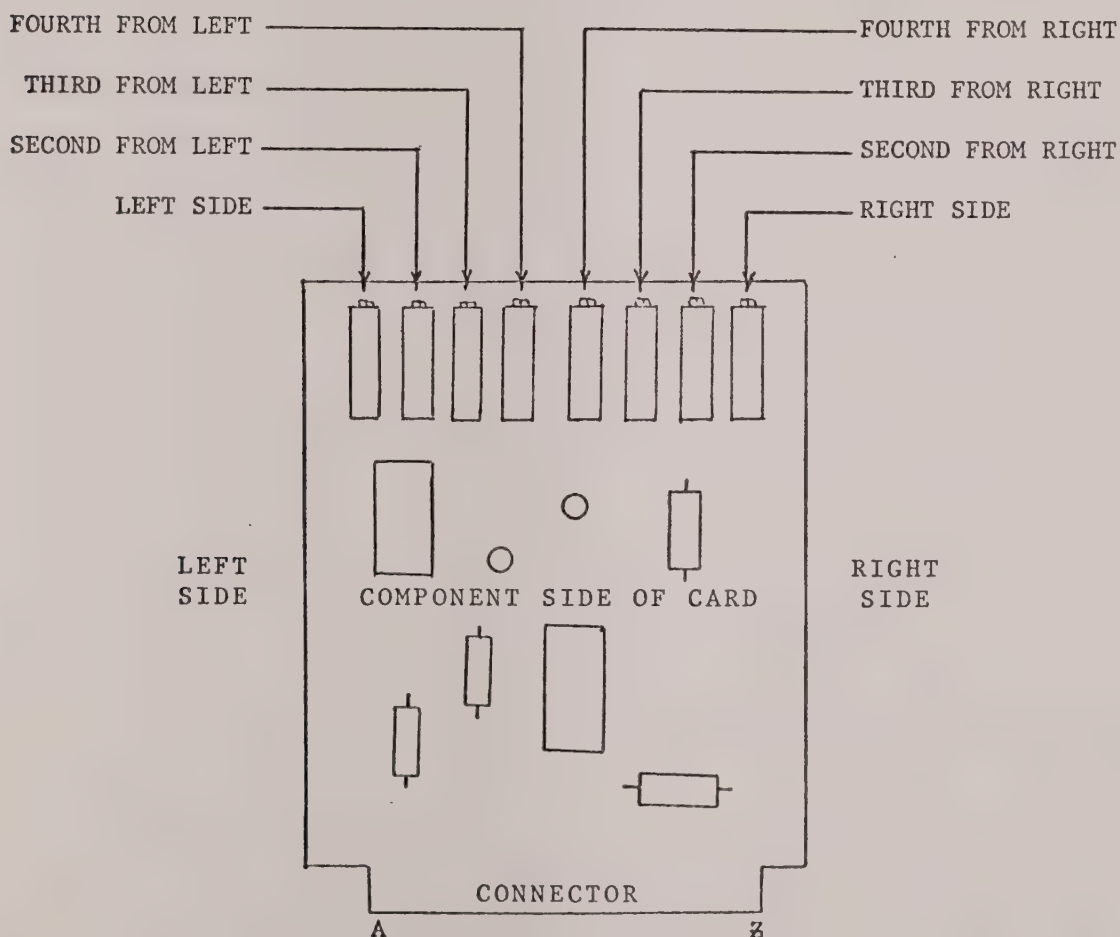


FIGURE 5 - Circuit Card Orientation

1

1

- Switch which selects scan rate as indicated by push button selectors.

- Toggle switch selection of the Broadcast sync waveform format (with 2H rate equalizing pulses and serrations in the vertical sync interval) Industrial, or Military format.

1

•

H SYNC

- The control second from left on the MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC card controls width of the pulse for the 525 and 625-line scan rates. The control at the left edge controls the width of the H Sync pulse for all other scan rates.

2H EQUALIZING PULSES WIDTH

- The control second from right on the MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS card adjusts width of Equalizing Pulses which occur, if selected, prior to and immediately after the V Sync interval, for the 525 and 625-line scan rates. The control at the right edge adjusts the Equalizing Pulse width for all other scan rates.

2H MASTER OSCILLATOR FREQUENCY

- The Master Oscillator frequency for the Free Run and AFC modes only is adjusted by the controls on the MULTIRATE BLANK/CONTROL cards. A separate control is provided for each rate; the control at the right edge is for the 525-line rate, the next control to the left is for the 625-line rate, etc. These controls are not functional for the Crystal mode.

PULSE AMPLITUDE

- The control at the right edge of the PULSE OUTPUT circuit card adjusts simultaneously the amplitude of output pulses (H Drive, V Drive, Blanking and Sync) over a range of 3.5v. to 4.5v. peak-to-peak when properly terminated. Nominal setting should be 4.0v. peak-to-peak.

SCAN RATE CHANGE AND SYNC FORMAT

This instrument has been designed for operation at various scan, field and frame rates at 2:1 interlace. This includes all rates specified by American EIA Standards RS-170, RS-330 and RS-343 which specify field and frame rates at 60 Hz and 30 Hz respectively, plus European rates which employ a 50 Hz field rate and 25 Hz frame rate, and other non-standard rates. Operation in a non-interlaced condition (1:1) is possible by special interconnection; please contact the factory for further information if operation in this mode is desired.

Instrument control ranges are designed to cover the ranges required by EIA Standard scan rates; components are stocked by the factory for these rates. Commonly used pulse proportions are shown on Table I, page 17. Contact the factory if non-standard scan rates are desired.

A scan rate is determined by the number of scan lines per field and the desired field repetition rate. The master oscillator frequency determines the rate at which horizontal lines are developed and that, in turn, determines what the frequency or repetition rate of the television field will be. By definition of 2:1 interlace, two fields constitute a frame; a frame is defined as one complete presentation of raster information. Therefore, the designation of 525/60/30 indicates that:

- a. There will be 525 horizontal scan lines per frame.
- b. The field rate shall be 60 Hz.
- c. The frame rate shall be 30 Hz.
- d. The ratio of field repetition rate to frame repetition rate determines the interlace ratio will be 2:1, which indicates that there will be two fields per frame, each field containing one-half of the total scanning lines - in this case 262.5.

The following information must be known before scan rate change can be accomplished:

1. Frame rate or Field rate

Frame rate equals field rate divided by the interlace ratio.

Example: If using 525-line scan rate, 60 Hz field rate, 2:1 interlace then:

$$60 \text{ Hz field rate} \div 2 = 30 \text{ Hz frame rate}$$

2. Scan lines per field

Scan lines per field equal scan lines per frame divided by interlace ratio.

Example: At the 525-line scan rate, interlaced 2:1,
 $525 \div 2 = 262.5$ lines per field

This is the count which must be developed in the sync generator circuitry to develop vertical rate pulses from horizontal information.

The count must be determined in binary sequence as follows:

$$\begin{array}{rcl} & 262.5 & \\ - & \underline{256.0} & \text{(largest possible binary integer)} \\ & 6.5 & \\ - & \underline{4.0} & \text{(next largest possible binary integer)} \\ & 2.5 & \\ - & \underline{2.0} & \text{(next largest possible binary integer)} \\ & .5 & \text{(obtained automatically from reset)} \end{array}$$

The numbers subtracted, 256, 4, and 2, are the binary count sequence which will total 262 and an additional count of 0.5 is obtained from counter reset. See Table I which has the information for standard and commonly used rates. See CONTROLS AND ADJUSTMENTS for access to circuit cards.

3. Master Oscillator Frequency

Master oscillator frequency is twenty times horizontal rate. Horizontal rate is the field rate multiplied by the number of lines per field or frame rate multiplied by the number of lines per frame.

Example: At the 525/60 scan rate:

H rate = frame rate x no. of lines per frame

$$30 \times 525 = 15,750 \text{ Hz}$$

$$20\text{H rate} = 20 \times 15,750$$

$$20\text{H} = 315,000 \text{ Hz or } 315.00 \text{ kHz}$$

Master oscillator frequency = 315.00 kHz

NOTE: It is recommended that the factory be contacted for more detailed procedure if change of scan rate is desired.

Procedure to change scan rate (See Table I)

1. Insert the crystal of proper frequency (determined in step 3) into the proper location on the MULTIRATE CRYSTAL circuit card (see drawing L-2034). This drawing shows the scan rate related to each crystal, and the calibration normally provided for that rate in a "standard" instrument.
2. Install programming diodes on MULTIRATE COUNT SELECT circuit cards per drawing L-2037 to count the number of t.v. lines per field. There are four groups of drawings for this card, with diodes selected as shown on page 2 of Parts List PL-2037 at the rear of this manual. Insertion of a diode will remove a count. For instance, the width of Vertical Blanking normally is 20 t.v. lines for the 525/60 scan rate. Diodes are not installed at positions CR57, Group 3, (Count 16) and CR41, Group 4 (Count 4) but at all other positions for this function (CR40, CR25, CR24, CR9 in Group 4 and CR56 in Group 3) leaving a count of $164 + 4 = 20$. Should it be desired to increase the pulse width to 22, merely remove the diode at position CR24, Group 4 to add the Count 2. Note that the total count for the number of scan lines per field, width of V Drive, or width of V Blanking will be a binary sum. That is:
 - for the 525-line rate, 2:1 interlace, the count per field is $262.5 (= 256 + 4 + 2 + 0.5 \text{ Reset internal})$.
 - for 1080-line rate, 1:1 interlace, the count per field is $540 (= 512 + 16 + 8 + 2 + 1 + 0.5 + 0.5 \text{ Reset internal})$.

- or -

this rate could be specified as 540-line, 1:1 interlace, describing the lines per field rather than lines per frame. The count would be the same.

- a V Blanking width of 33 lines would be obtained by a count of $(32 + 1 = 33)$
- a V Drive width of 10.5 lines would be obtained by a count of $(8 + 2 + 0.5 = 10.5)$.

Table I, page 17, shows the counts normally used for the "standard" scanning rates. Install or remove diodes as necessary to obtain the proper count for the number of horizontal t.v. lines per field, width of V Blanking, and width of V Drive.

3. Adjust the horizontal rate pulses to the desired width:

- H Blanking
- H Drive
- H Front Porch
- H Sync
- 2H Serrations
- 2H Equalizing Pulses

These adjustments should be made while observing the Sync signal in the Broadcast mode, even though this mode is not to be used. If no specification is given for the 2H Serration and Equalizing pulses for the scan rate being used, adjust them as shown for the 525/60 and 875/60 rates (Table I) for the Lo and Hi modes. In "standard" instruments, there are two modes of horizontal rate pulse widths. The Lo mode normally is selected by Scan Rates A and B (525/60 and 625/50) and the Hi mode by all other rates. If this instrument has been modified for other rates, check which mode has been provided for each rate.

The Sync signal waveform may be presented in any one of three formats consistent with the scan rate being used:

- a. Broadcast-type sync with 2H rate Equalizing Pulses for three scanning line intervals (6 pulses) before and after the vertical sync interval, 2H rate Serrations during the three-line vertical sync interval (6 pulses) and horizontal front porch as specified in EIA Standard RS-170 and shown as optional in EIA Standards RS-330A and RS-343A.
- b. Industrial-type sync the same as above, without Equalizing Pulses and Serrations, per EIA Standards RS-330A and RS-343A.
- c. Military-type sync which does not include Equalizing Pulses or serrations, has no horizontal front porch, and no horizontal rate pulse information during the vertical front porch of three scan line duration.

Selection of the desired waveform is accomplished by front panel control.

PERFORMANCE VERIFICATION AND CALIBRATION

Sync Source generators operate automatically, developing an analog television signal through digital technique. Therefore, no extensive calibration is required, unless component replacement is undertaken. Internal controls are provided for horizontal rate pulse widths. These are to be adjusted as desired for the particular application of the equipment and should be checked if any components in the cards are replaced. Also, their values should be readjusted if another card is inserted into the unit.

Vertical timing is controlled by the counter circuits and, therefore, is automatically locked to the horizontal rate. Pulse proportions can be adjusted by internal programming modification, as described under SCAN RATE CHANGE AND SYNC FORMAT.

Equipment

1. Any good, general purpose oscilloscope with adequate high frequency response is suitable for inspection of the waveforms. Calibration of the Sync Source 1303 requires an oscilloscope response that is flat (± 0.5 db) to greater than 30 MHz to show complete detail of risetime. Direct coupling (d.c.) is preferred to prevent false appearance of a tilt on the video waveform at vertical rate. The oscilloscope should have provisions for external synchronization from either Horizontal or Vertical Drive to view the composite video output waveform with convenience. Also, a Delaying sweep capability will permit inspection of selected horizontal lines within the vertical television field. Typical instrumentation suited for this use would be the Tektronix Type 453 or equivalent.
2. A UG-274/U BNC series coaxial cable tee and 75 ohm termination, Dage 540-2 or equivalent.
3. A minimum of two coaxial cables, RG59B/U, no more than three feet in length with BNC connectors.

Voltage Levels

Power supply levels in the parent unit must be verified to +12v., +5v., and -5v. to establish proper reference levels for all operations. A test point is provided on the POWER REGULATOR card as shown in Drawing L-2001 to check the voltage levels. Refer to the test pattern generator instruction manual for further information on voltage test and adjustment. Then proceed to the itemized procedure as listed below.

Calibration Procedure

Vertical timing is controlled by the counter circuits, and therefore is automatically locked to the horizontal rate. Pulse proportions can be adjusted by internal wiring modification; refer to SCAN RATE CHANGE AND SYNC FORMAT section if such adjustment is desired. All horizontal proportions are adjustable and may be set to the exact pulse width desired for particular application. The logic operates in two modes, "low" and "high", the 525/60 and 625/50. The "high" mode provides the pulse widths for all higher scan rates, 729 through 1225. Two sets of controls are provided on the MULTIRATE DUAL MONO circuit cards for calibration of the separate modes. Calibration of the "low" mode is completed at the 525/60 rate; the "high" mode is calibrated at the 875/60 rate.

525/60 LINE RATE

1. Select the 525/60-line scan rate at the front panel.
2. Refer to Table I for proper timing relationships for the 525-line scan rate. See Figures 1 and 2 for conformance to typical waveforms. Select the BROADCAST sync waveform mode.
3. Sync the oscilloscope from the leading edge (-) of H Drive. Set oscilloscope sweep rate as desired for inspection of timing as described in each step of adjustment.
4. Observe the H Drive waveform at the rear panel. Pulses should be 8 volts, pk-pk (unterminated) negative going with leading edges spaced at 63.4 usec. Adjust the pulse width to the proper value by use of the control second from left on the MULTIRATE DUAL MONO/H DRIVE & H BLANKING card, (Group 3).
5. Observe the Blanking output, with oscilloscope sync remaining at H Drive. Observe amplitude, polarity and leading edge spacing to be as described above. Adjust H Blanking pulse width by use of the control second from the right on the MULTIRATE DUAL MONO/H DRIVE & H BLANKING card, (Group 3).
6. Sync the oscilloscope from the leading edge (-) of V Drive. Observe the V Drive waveform and check polarity, level and width (nominally 667 usec.). The pulses should be spaced 16,667 usec apart, occurring at a 60 Hz rep rate.

For this rate only, switch oscilloscope sync to Line; the pattern should either be stationary or drift very slowly to the right or left. A rapid travel or apparently out of sync signal indicates that the vertical rate is incorrect, due to improper master oscillator frequency or improper line count. Note that this test cannot be made for rates not developing a 60 Hz field, such as the 625/50 rate, where the field rep rate is not the same as the power line frequency.

7. Observe the Blanking output and check level, polarity and width of the V Blanking interval (20 lines, 1250 usec.). The H Blanking pulses (as adjusted in step 5) should be present at all times except during V Blanking interval. The upper and lower baselines should be uniform with no tilt, sag or modulation.

8. Sync oscilloscope to the leading edge (-) of V Drive. Set oscilloscope sweep at 2 msec/div.

Observe the SYNC output and inspect for proper waveform. The sync waveform may be presented in any one of three formats (as described on page 27) by selection at the front panel switch.

This procedure assumes the use of Equalizing Pulses, Serrations and horizontal Front Porch. If they are not used, the procedure should be varied accordingly. Note presence of positive serrations in the V Sync Interval (from 3H to 6H past V Drive leading edge, from 190 usec to 380 usec at 525-line rate) if they are used. It may be necessary to expand the sweep for this observation; delaying sweep at approximately 50 usec/div also will permit convenient viewing of the V Sync interval. Six serration pulses should be present in the V Sync interval (occurring at 2H rate).

Observe that six Equalizing pulses are present before and after the V Sync interval, if used, also at 2H rate (spaced 31.70 usec for 525-line rate). Do not adjust pulse widths at this time.

9. Continue to observe the Sync output. Sync oscilloscope from the leading edge (-) of H Drive, sweeping scope at a convenient rate to show the H Sync pulses.
10. The serrations will appear as a faint trace of positive pulse half way between the H Sync pulses. Adjust the control second from left on the MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS card (Group 2) for proper serration pulse width. The trailing edge of this pulse is the leading edge of H Sync.

NOTE: Gross misadjustment of the MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS card (Group 2) can cause an apparent loss of horizontal front porch, particularly if the front porch adjustment is longer than serration timing. Should this occur, adjust the Front Porch control to minimum and Serration control to maximum pulse lengths. Front porch should then appear; complete adjustments in manner described below.

11. Adjust the front porch (leading edge delay) by use of the control second from right on the DUAL MONO/H FRONT PORCH & H SYNC card (Group 1). Then adjust the width of H Sync pulse by use of the control second from left on the MULTI-

RATE DUAL MONO/H FRONT PORCH & H SYNC card (Group 1). Adjust Equalizing pulse width by use of the control second from right on the MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS card (Group 2). Equalizing pulses will appear as a faint trace inside the H Sync pulse outline.

12. Sync the oscilloscope from the leading edge (-) of V Drive. Set oscilloscope sweep at 2 msec/div. Using the scope delayed sweep to inspect the vertical sync interval closely. Check that the SYNC FORMAT switch produces the proper waveform format of Sync signal as selected. Refer to Figure 3.
13. The output synchronizing pulses are adjustable over a nominal range of 3.5v. to 4.5v. peak-to-peak when outputs are properly terminated. Adjust the output pulse amplitude as desired, usually to 4.0v- pk-pk, using the control at the right edge of the PULSE OUTPUT circuit card. Note that this control provides simultaneous adjustment to all four outputs: H Drive, V Drive, Blanking and Sync.

625/50 - LINE RATE

1. The calibration procedure for the 525/60 rate should have been completed before proceeding further. Select the 625/50 line scan rate.
2. Check that all adjustments as set, following the procedure under 525/60-line rate, steps 2 through 13, are the same. In step 6, pulse will be spaced 20,000 usec. apart, not 16,667 usec. as noted for the 525/60 rate.

875/60 - LINE RATE

1. Select the 875/60-line scan rate at the front panel.
2. Refer to Table I for proper timing relationships for the scan rate. See Figures 1 and 3 for conformance to typical waveforms. Select the BROADCAST waveform mode.
3. Sync the oscilloscope from the leading edge (-) of H Drive. Set oscilloscope sweep rate as desired for inspection of timing as described in each step of adjustment.
4. Observe the H Drive waveform at the rear panel. Pulses should be 8 volts, pk-pk (unterminated) negative going with leading edges spaced 38 usec. Adjust the pulse width to the proper value by use of the control at the left edge of the MULTIRATE DUAL MONO/H DRIVE & H BLANKING card (Group 3).

5. Observe the Blanking output, with oscilloscope sync remaining at H Drive. Observe amplitude, polarity and leading edge spacing to be as described above. Adjust H Blanking pulse width by use of the control at the right edge of the MULTIRATE DUAL MONO/H DRIVE & H BLANKING card (Group 3).

6. Sync the oscilloscope from the leading edge (-) of V Drive. Observe the V Drive waveform and check polarity, level and width (nominally 667 usec.). The pulses should be spaced 16,667 usec. apart, occurring at a 60 Hz rep rate.

Switch oscilloscope sync to Line; the pattern should either be stationary or drift very slowly to the right or left. A rapid travel or apparently out of sync signal indicates that the vertical rate is incorrect, due to improper master oscillator frequency or improper line count. Note that this test can be performed only if the vertical field rate is 60 Hz and cannot be used for special rates which develop other field rep rates.

7. Observe the Blanking output and check level, polarity and width of the V Blanking interval (33 lines, 1250 usec.) The H Blanking pulses (as adjusted in step 5) should be present at all times except during the V Blanking interval. The upper and lower baselines should be uniform with no tilt, sag or modulation.

8. Sync oscilloscope to the leading edge (-) of V Drive. Set oscilloscope sweep at 2 msec/div.

Observe the SYNC output and inspect for proper waveform. The sync waveform may be presented in any one of three formats (as described on page 27) by selection at the front panel switch.

This procedure assumes the use of Equalizing Pulses, Serrations and horizontal Front Porch. If they are not used, the procedure should be varied accordingly. Note presence of positive serrations in the V Sync Interval (from 3H to 6H past V Drive leading edge, from 114 usec to 228 usec at 875-line rate) if they are used. It may be necessary to expand the sweep for this observation; delaying sweep at approx. 50 usec/div. also will permit convenient viewing of the V Sync interval. Six serration pulses should be present in the V Sync interval (occurring at 2H rate).

Observe that six Equalizing pulses are present before and after the V Sync interval, if used, also at 2H rate)spaced 19 usec for 875-line rate). Do not adjust pulse widths at this time.

9. Continue to observe the output. Sync oscilloscope from the leading edge (-) of H Drive, sweeping scope at a convenient rate to show the H Sync pulses.
 10. The serrations will appear as a faint trace of positive pulse half way between the H Sync pulses. Adjust the control at the left edge of the MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS card (Group 2) for proper serration pulse width. The trailing edge of this pulse is the leading edge of H Sync.
- NOTE: Gross misadjustment of the MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS card (Group 2) can cause an apparent loss of horizontal front porch, particularly if the front porch adjustment is longer than serration timing. Should this occur, adjust the Front Porch control to minimum and Serration control to maximum pulse lengths. Front Porch should then appear; complete adjustments in manner described below.
11. Adjust the front porch (leading edge delay) by use of the control at the right edge of the MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC card (Group 1). Then adjust the width of H Sync pulse by use of the control at the left edge of the MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC card (Group 1). Adjust Equalizing pulse width by use of the control at the right edge of the MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS card (Group 2). Equalizing pulses will appear as a faint trace inside the H Sync pulse outline.
 12. Sync the oscilloscope from the leading edge (-) of V Drive. Set oscilloscope sweep at 2 msec/div. Using the scope delayed sweep to inspect the vertical sync interval closely. Check that the SYNC FORMAT switch produces the proper waveform format of Sync signal as selected. Refer to Figure 3.
 13. Check that output pulse amplitudes remain at the level as adjusted in step 13 for the 525/60 scan rate, page 32.

945/60 THROUGH 1225/60 RATES

All rates not calibrated by the previous detailed procedure for 525/60, 625/50, and 875/60 are in the "high" rate mode, and have the same horizontal pulse (H Blanking, H Drive, H Front Porch, H Sync, 2H Equalizing Pulses and 2H Serrations) widths as set for the 875/60 rate. Refer to that procedure if any discrepancy is observed in the following procedure. The SPECIAL rate will be 729/60 unless customer specifications request otherwise. Refer to Table I (Page 15) for pulse timing and proportions.

For each of the remaining rates (945/60, 1023/60, 1029/60, 1225/60, and SPECIAL @ 729/60) check the following items for each rate after completion of the 875/60 procedure:

1. Select scan rate to be tested. Refer to Table I for proper timing relationships for the scan rate in use. See Figures 1 and 3 for conformance to typical waveforms. Select BROADCAST waveform mode.
2. Sync the oscilloscope from the leading edge (-) of H Drive. Set oscilloscope sweep rate as desired for inspection of timing as described in each step of adjustment.
3. Observe the H Drive waveform at the rear panel. Pulses should be 8 volts, pk-pk (unterminated) negative going with leading edges spaced as shown on Table I for the various scan rates. Check pulse width.
4. Observe the Blanking output, with oscilloscope sync remaining at H Drive. Observe amplitude, polarity and leading edge spacing to be as described above. Check pulse width.
5. Sync the oscilloscope from the leading edge (-) of V Drive. Observe the V Drive waveform and check polarity, level and width (nominally 667 usec.). The pulses should be spaced 16,667 usec apart, occurring at a 60 Hz rep rate.

If the vertical field rate is 60 Hz, switch oscilloscope sync to Line; the pattern should either be stationary or drift very slowly to the right or left. A rapid travel or apparently out of sync signal indicates that the vertical rate is incorrect, due to improper master oscillator frequency or improper line count.
6. Observe the Blanking output and check level, polarity and width of the V Blanking interval (nominally 1250 usec.). The H Blanking pulses (as adjusted in step 4) should be present at all times except during V Blanking interval. The upper and lower baselines should be uniform with no tilt, sag or modulation.
7. Sync oscilloscope to the leading edge (-) of V Drive. Set oscilloscope sweep at 2 msec/div.

Observe the Sync output and inspect for proper waveform. The sync waveform may be presented in any one of three formats (as described on page 27) by front panel selection.

TROUBLESHOOTING

This Sync Generator has been designed to provide the greatest reliability possible in the normal laboratory environment. Unfortunately some components, particularly capacitors and semiconductors, exhibit a limited lifetime, and lead to the possibility of component failure. In this instrument the components are derated to assure the longest possible lifetime.

Be sure to check the calibration procedure to establish that failure has occurred definitely. Often a symptom of difficulty can be traced to improper adjustment of the unit.

Failures which would occur relatively early, are most likely due to semiconductor (transistor) failure or to defective solder joints. Failures occurring at later times statistically would be attributed to electrolytic capacitor failure due to internal chemical reaction.

In rare instances, there may appear in this equipment a deviation from the part as called out on the schematic and in the parts list. This is especially true in the case of semiconductor devices, diodes and transistors, where a number of types are interchangeable. The right is reserved to make use of interchangeable components where such substitution will provide equal or superior performance to that specified. It is suggested that if replacements are required, the type specified in the parts list be procured.

You are urged to read the instruction manual completely before connecting the Sync Source generator for operation. Observance of only a few procedures will provide greater operator convenience and will assure most effective application of the equipment as well as provide maximum safety to the user.

CAUTION

Even low voltages commonly present in transistorized circuits are potentially dangerous. Additionally, full line voltage is present on fuse terminals, power switch terminals and other exposed points within the interior of the unit, and are accessible when the cover of the equipment is removed. Caution should be exercised, as follows:

- a. Remove power by unplugging the line cord when removing covers and inspecting interior of the unit.
- b. Observe the common safety practices when servicing equipment (dry skin, insulation of the body from ground, etc.).
- c. Never work on electrical equipment when alone.

Fault isolation can be achieved most efficiently by determining the circuit card module causing difficulty, from symptoms in the output waveforms.

Lack of a proper output signal can usually be traced to problems in the power supply or related chassis problems. Check that the output signals conform to typical waveforms. If there is a problem in one of these signals, troubleshoot the proper section.

- a. If all waveforms are missing, power is applied, the power switch is turned to the ON position, the pilot light should be lit. If it is not, check the fuse (located on the rear panel). If the pilot light is lit, check all internal d.c. power levels. Check that the master oscillators are operating properly. Check operation of the H Front Porch monostable multivibrator on the MULTIRATE DUAL MONO/H DRIVE and H BLANKING card (Group 1).
- b. If pulse timing and format appear correct but output pulses are missing, amplitude is not proper, or a.c. ripple appears in all of the output waveforms, check the +12v. power supply in the parent unit and PULSE OUTPUT card output stages and pulse level control. If only one waveform is missing or has improper level, check the appropriate output section of the PULSE OUTPUT card.
- c. If H Drive is proper, but V Drive, Blanking and Sync are improper at vertical rate, check the vertical count programming and operation, MULTIRATE SYNC COUNT and MULTIRATE COUNT SELECT cards.
- d. If H Drive and/or horizontal rate Blanking pulses are missing or occur at 2H rate, but V Drive is proper, check the 2:1 count on the MULTIRATE SYNC COUNT card.
- e. If the H Drive or Horizontal rate Blanking pulses are of incorrect width, or erratic, check the MULTIRATE DUAL MONO/H DRIVE and H BLANKING card, Group 3 circuitry.
- f. If the V Drive or vertical rate Blanking pulses are improper but H Drive and Sync waveforms are normal, check circuitry on the MULTIRATE BLANK/CONTROL card.
- g. If only the Blanking waveform is abnormal, but amplitude is correct, check mixing circuitry on the MULTIRATE BLANK/CONTROL card.

- h. If the Sync waveform only is improper in format or timing but amplitude is proper, check circuitry on the MULTIRATE V SYNC and MULTIRATE DUAL MONO, H FRONT PORCH and H SYNC and MULTIRATE DUAL MONO H DRIVE and H BLANKING cards (Groups 1 and 2).

Operation of each of these cards is discussed in detail under CIRCUIT DESCRIPTION; refer to the appropriate paragraphs after fault isolation as described above.

LIMITED WARRANTY

Signal Source equipment is guaranteed to be free of defects in material and workmanship for a period of one year from date of shipment, when operated in accordance with the instructions and specifications provided. Such limited warrant is made in lieu of any other guarantee or warranty, expressed or implied, and is offered only to the original purchaser. If such defects are confirmed through our inspection, the product will be repaired or replaced, at our option, without charge to the purchaser for parts or for labor. This warranty does not cover damage which occurs in shipment or due to misuse or abuse of the apparatus, and is not applied to cables or decorative, stained or painted finishes.

Those requesting adjustment through the terms of this warranty are instructed to contact the factory for authorization to return the equipment before shipment. Items for which authorization is issued are to be sent prepaid.

Signal Source equipment is designed and constructed using the most effective and safest industrial practice known, and in accordance with printed and accepted practices for fabrication of industrial electronic equipment. Inasmuch as Visual Information Institute, Inc. has no control over the manner in which the instrument is used, or over systems into which the equipment will be interconnected, the corporation cannot and does not assume any liability for circumstances or damages arising from use of this equipment.

This warranty does not apply to equipment which has been modified in any way to other than the original factory configuration.

CAUTION

When removing and replacing jumpers on printed circuit cards, do not overheat card and lift printed circuit card copper pads. Use vacuum device to remove solder before existing jumper is removed. Jumper removal and replacement must be done by those experienced with printed circuit cards. Damage to printed circuit cards caused by improper methods will void the warranty.

ACCESSORIES AND SERVICE

Vii products are designed for long, reliable service under adverse operating environments. It should require a minimum of maintenance or service if properly applied.

We stand ready to assist in advising as to proper application of our products, to aid in servicing instruments, and to help in CCTV system layout and operation for maximum of utility in the application of television of all areas.

A number of accessories are available for extended operation of Signal Source equipment, including special housings, cables, etc., especially designed to suit unusual requirements. Special configurations of Signal Source generators are available for integration into existing or contemplated systems, such as units without cases, special accessory functions brought to the front panel, etc.

If your equipment should malfunction or develop operating difficulty, the factory offers a service and overhaul program for a labor fee plus cost of parts, transportation and insurance. Prompt attention to your equipment is pledged; do not hesitate to contact the factory in these instances.

CIRCUIT DESCRIPTION

The Sync Source 1303 Multirate TV Sync Generator Accessory follows the fundamental pattern employed for such devices for some time. The traditional format is used to permit flexibility in application; the output pulses can be adjusted to operate at the nominal values called out by current standards or elsewhere within or exceeding the prescribed tolerance range. Also the one set of circuit cards is operable at all recommended scan rates without major circuit alteration. Therefore, the generator easily can be made to match any system to which it is applied.

The signals are synthesized through modern digital techniques; the generator circuits are completely transistorized, composed of multivibrators which employ high speed switching transistors. All power supplies are closely regulated to insure dependable, stable operation over wide variations in ambient conditions.

Power for sync generator operation is taken from regulated supplies in the parent unit. D.C. levels of +12v., +5v., and -5v. are required.

In order to provide interlace, the master oscillator operates at 20 times the horizontal rate. The clock rate is divided by ten to twice horizontal (2H) rate on the MULTIRATE SYNC COUNT card. The serrations and equalizing pulses are developed from this master timing reference, at the 2H rate. From this point, the master timing pulses are divided by the count on the MULTIRATE SYNC COUNT card to generate horizontal (H) rate and vertical (V) rate pulses.

The various Master Oscillators to develop the basic clock rate required for generation of the desired sync pulses, crystal controlled for maximum stability, are developed on the MULTIRATE CRYSTAL card.

The 2H front porch pulses are developed on the MULTIRATE DUAL MONO/H FRONT PORCH and H SYNC card (Group 1) and submitted to a 2:1 count at the MULTIRATE SYNC COUNT card. Therefore a controlling H-rate pulse is developed for generation of H Blanking, and H Drive; these particular pulses are generated by individual monostable multivibrators on their respective MULTIRATE DUAL MONO circuit cards.

The 2H rate front porch pulses are also submitted to a counter which develops the vertical (V) rate. This circuit develops a V reset which acts as the trigger to generate vertical pulses

which signify the end of a television field (two fields constitute a frame which is one complete presentation in the vertical dimension of the television raster). Programming diodes are located on the MULTIRATE COUNT SELECT cards to determine the number of horizontal lines in the frame.

Vertical pulses, initiated by the V trigger formed on the MULTIRATE V SYNC card, are controlled for proper width by count of horizontal lines. A matrix is included on the MULTIRATE COUNT SELECT cards to control width of the V Blanking and V Drive pulses which are developed on the MULTIRATE BLANK/CONTROL card. The V Sync pulse is at all times delayed by a 3H front porch from the start of V Blanking, and always is 3H (the time of three horizontal lines) in width by circuitry on the MULTIRATE V SYNC card.

The V Drive and H Drive pulses are developed and routed to the output circuits with no further processing. The H and V components of Blanking are mixed into the Composite Blanking signal on the MULTIRATE BLANK/CONTROL card, and then processed for utilization on the PULSE OUTPUT card. The H Sync, 2H Serration, and 2H Equalizing pulses are developed on their respective MULTIRATE DUAL MONO circuit cards. Vertical sync proportions are developed on the MULTIRATE V SYNC card. Components of the sync signal are processed on the MULTIRATE V SYNC card to generate the desired Composite Sync signal which includes both vertical and horizontal synchronizing information.

The Multirate Sync Generator develops precise synchronizing signals for use in industrial, education and laboratory television applications. The waveform format is selectable. The Broadcast format is in accordance with EIA Standard RS-170, in that it provides equalizing pulses and horizontal rate serrations in the vertical sync interval. It meets all requirements of Standards RS-343, RS-170 and RS-330 for synchronizing signals.

The Industrial format meets the requirements of EIA Standards RS-330 and RS-343, while the Military format is not referenced in present standards. The format is selected through logic operation on the MULTIRATE V SYNC card.

Detailed Circuit Description

The master oscillators are located on the MULTIRATE CRYSTAL card. The card contains eight separate, identical oscillator sections composed of an integrated circuit oscillator, associated crystal, and output isolating, driver stage (for instance Z1, X1,

R1, R2 and Q1). The 20H (twenty times horizontal repetition rate) crystal frequency is selected for the scan rate desired, as shown in Table I. A particular oscillator is placed in use by application of +5v. to the desired circuit. All output stages, Q1 through Q8, have collectors connected to the output at Pin C. Stages not in use are biased off through negative voltage to the base (R2). When a stage is energized, bias is shifted so that signal through the driving resistor (R1) causes the proper output stage to act as a saturated switch.

The 20H master oscillator signal is routed to the 10:1 integrated circuit Z5 on the MULTIRATE SYNC COUNT card, developing a 2H rate signal at switching transistor Q3.

The 2H rate pulses are submitted to isolating stage Q5 on the MULTIRATE SYNC COUNT card, then to 2:1 count Z6B which develops the horizontal rate at Pins M and N. The 2H pulses also are routed to programmable counter Z2, Z3, Z4, Z7, Z8 and Z6A which develops the vertical rate. A vertical rate trigger is developed by interaction of selected counts on the MULTIRATE COUNT SELECT cards, developing a trigger for integrated circuit monostable Z1 which resets the counter at the start of every television field.

Vertical count selection is determined by selective feedback per control switch settings. Outputs from the J-K flip flop binary count stages on the MULTIRATE SYNC COUNT card are routed to inverter gates (Z4D) then NAND gates (Z3C) on the MULTIRATE COUNT SELECT cards. The NAND gate second input is routed to a positive voltage through a resistor (R1) to make this input inoperative. Thus the pulse is routed through the NAND gate (Z3C) to the Reset buss (Pin E). If the count is not to be used, the resistor (R1) is grounded through a diode (CR41), blocking the flow of pulses through the NAND gate (Z3C). Thus selection of diode location determines which counts will be used for development of the vertical rate trigger pulse for each scan rate. Each MULTIRATE COUNT SELECT card has eight stages; three cards are used to allow use of up to eleven scan rate counts plus thirteen stages used to develop V Blanking and V Drive pulse widths.

An optional feature is configuration of a scan rate for non-interlace (1:1 interlace). Selection of a whole line count, plus 0.5 line for development of reset provides the normal 2:1 interlace condition. To provide 1:1 interlace the count is extended 0.5 line by control of the 0.5 line count (Pin A, gate Z1B). Contact the factory for further details on operating in this mode.

Specification RS-170 requires that serrations of horizontal rate be produced during the vertical sync interval. Serration polarity is opposite that of the horizontal pulses to permit detection of the vertical sync. Therefore, the negative trailing edge of the serration pulses becomes a timing reference as opposed to the negative leading edge of the horizontal sync pulses. The pulses from the master oscillator are routed to the MULTIRATE DUAL MONO/H FRONT PORCH and H SYNC (Group 1) card where the serration pulse width is produced. From this point on, the trailing edge of the serration pulse is used as timing references. However, the leading edge of blanking must take place previous to the timing reference. Therefore, the horizontal 2H master timing pulses are routed to the second half of the MULTIRATE DUAL MONO/H FRONT PORCH and H SYNC (Group 1) card, where a time delay is developed to generate the proper start of blanking. This establishes the width of horizontal front porch.

The counts thus selected are added at resistor R1 on the MULTIRATE SYNC COUNT card. When all desired counts have accumulated, a transition is developed at R1 to trigger monostable Z1. The pulse output from Z1 is used to reset all J-K flip flop stages (Z2 through Z6A, pins 2 and 6) to initial conditions, thus restarting the count sequence.

The vertical rate blanking and drive pulses are developed on the MULTIRATE BLANK/CONTROL card. A vertical rate trigger is developed on the MULTIRATE V SYNC card by monostable multivibrator Z1 and submitted to bistable latches Z1-C,D and Z2-C,D through Pin V, starting a pulse at each of these bistable elements. The pulses are terminated by turn off triggers developed from the MULTIRATE COUNT SELECT cards and routed through inverter gates Z1A and Z1B. When the respective outputs go negative, bistables Z1-C,D and Z2-C,D return to their original state. Pulse widths are determined by placement of programming diodes on the MULTIRATE SYNC COUNT cards as discussed above.

The V Drive pulse is routed out of the MULTIRATE BLANK/CONTROL card through Pin U to the PULSE OUTPUT card for further processing. The horizontal component of Blanking is mixed with the vertical blanking pulse by nand gate Z2B. The mixed Blanking signal is inverted by gate Z2A, then routed through Pin R to the PULSE OUTPUT card.

Sync is a complex combination of h-rate and 2h-rate pulses, a mixture of h-sync, 2h-equalizing pulses, and 2h-serration pulses. The leading edge of sync is positional with respect to the leading edge of blanking by the front porch pulse, if used.

The h-rate sync pulse is developed by monostable multivibrator Q11-Q14 or the MULTIRATE DUAL MONO/H FRONT PORCH and H SYNC (Group 1) card. The monostable is triggered by a pulse processed on the MULTIRATE V SYNC to insert or remove the horizontal front porch as required by sync waveform format. The sync pulse is processed by gate Z3A on the MULTIRATE V SYNC card, which has a 2:1 count input from the MULTIRATE SYNC COUNT card.

The sync trigger is developed by gates Z6B and Z8-C,D on the MULTIRATE V SYNC card. If the front porch delay is to be inserted, the serration pulse is added to the sync trigger signal (Pin S) by gate Z6B. If both inputs to gate Z8D are at high level, forcing the output to Z8D low at all times, action of Z8C is blocked. This blocks the serration pulse, causing the sync trigger to be advanced to the trailing edge of the front porch pulse, eliminating the delay.

The equalizing pulse, also at 2H rate, is developed by monostable multivibrator Q4-Q7 on the MULTIRATE DUAL MONO/2H EQUALIZING and 2H SERRATIONS, Group 2, card. It is triggered from the same pulse as the h-rate sync pulse, as discussed above.

The serration pulses, also at 2H rate, are developed by monostable Q11-Q14 on the MULTIRATE DUAL MONO/2H EQUALIZING and 2H SERRATIONS, Group 2, card. It is triggered by the 2H master oscillator pulses discussed previously.

The front porch pulse is used to set the timing edge of the H Drive and H Blanking pulses with respect to the Sync pulses. This pulse is shorter than the serration pulse by the desired front porch interval, developed by monostable Q4-Q7 on the MULTIRATE DUAL MONO/H FRONT PORCH and H SYNC, Group 1, card. This pulse is also used to operate the vertical rate counter.

Vertical Sync is a pulse developed within the vertical blanking interval, ordinarily delayed 2H from the start of the blanking and having a duration of 3H. Therefore, it is necessary to provide bistable multivibrators in the MULTIRATE V SYNC card, to produce the front porch delay and the vertical sync width. It is a further requirement that the vertical sync pulse be absolutely locked to the horizontal scanning rate. Therefore, pulses from the MULTIRATE COUNT cards are used to control bistable multivibrators which develop the vertical sync timing relationships.

Edges of the V Sync pulse should be coincident with the edges of H Sync. Therefore the pulses from the counter to select sync pulse widths are delayed by the serration pulse; gates Z9-A,B,C,D insert this delay prior to sync pulse logic.

Bistable Z4-A,B produces a pulse three lines long (V front porch), Z2-C,D produces a six line pulse, and a pulse nine lines in length is produced by bistable Z6-C,D. Gate Z2A combines the three line and six line pulses to one which extends from the third to sixth line in the vertical interval, the V Sync pulse. Gate Z3D combines the nine line pulse with the V Sync pulse to make two pulses, one from the start of the vertical interval to the third line, and another from the sixth to ninth lines; this pulse series is used to control the insertion of equalizing pulses before and after V sync.

All of these components - H sync, 2H equalizing pulses and 2H serrations - are combined into the sync waveform in one of three selectable formats:

- a. With equalizing pulses and serrations - H sync pulses are transmitted through gate Z7C except from the first to ninth lines of the vertical interval, as determined by gate Z3C. Equalizing pulses at 2H rate are introduced from the first to third and sixth to ninth lines through gate Z3B which is controlled by inverter Z5, using the control pulse from gate Z3D. Serrations at 2H rate are inserted from the third to sixth lines of the vertical interval by gate Z7A.
- b. Without equalizing pulses and serrations - Equalizing pulses are not permitted through gate Z3B, which is turned off by inverter Z5C, controlled by grounding the inverter input at resistor R7 (Pin E). This also turns off gate Z3C and turns on Z7D, deleting sync pulses from the third to sixth lines of the vertical interval, substituting h-rate sync pulses for the 2H equalizing pulses. Serrations are blocked from passing through gate Z7A by the control level at R10, as controlled by inverter Z5 and the voltage at R11 (Pin J). A vertical sync pulse without H or 2H rate information results.
- c. Military waveform - The sync waveform used in certain systems requires that there be no H rate or 2H content in the vertical front porch and that there be no equalizing pulses and serrations as well as no horizontal front porch. Therefore Pins E and J are grounded as in (b) above, as is Pin H and Pin X.

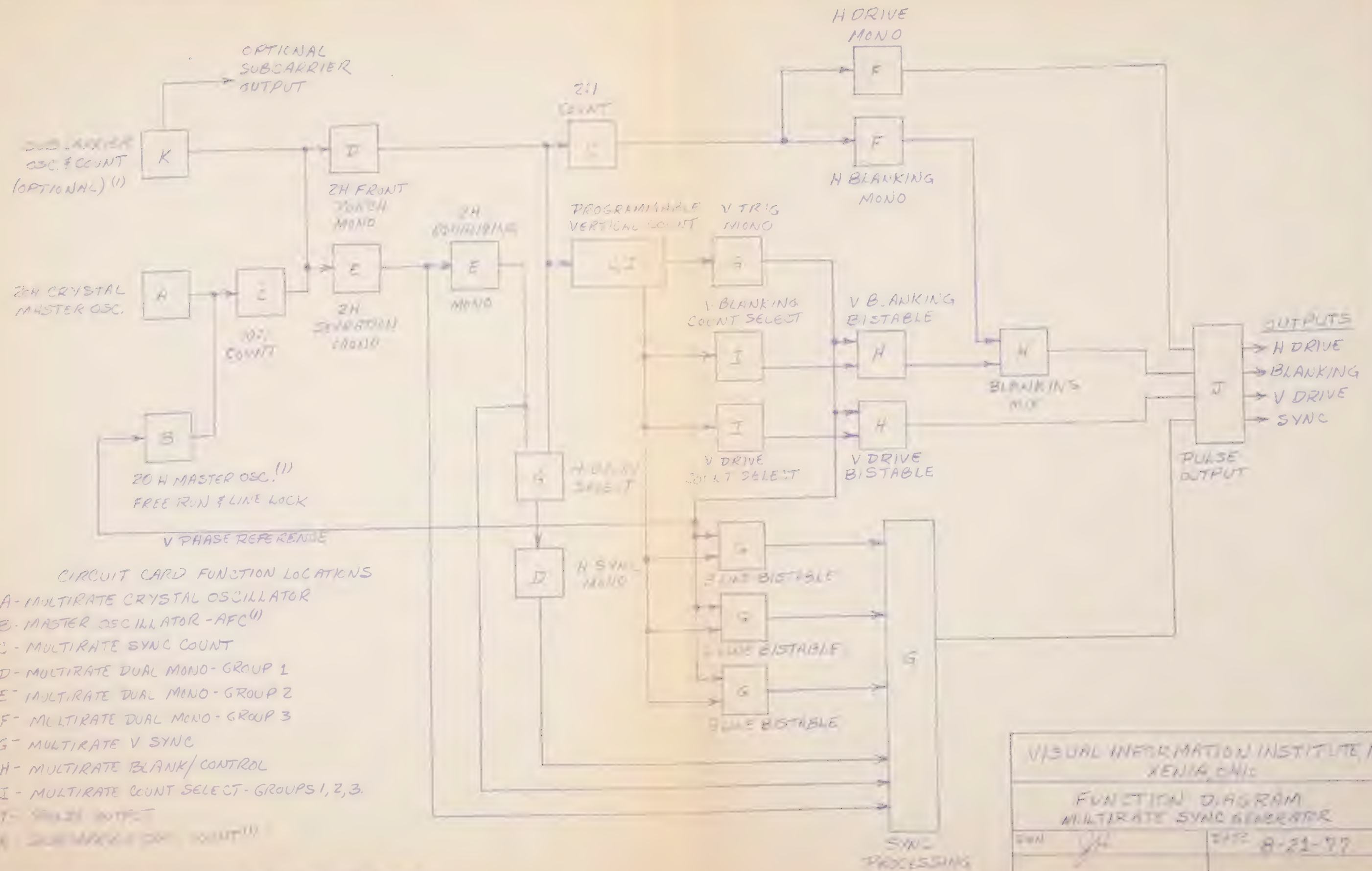
Sync generator outputs (H Drive, V Drive, Blanking and Sync) are processed through the PULSE OUTPUT card to properly drive coaxial cable at the required amplitude and impedance. Four identical circuits are used. The input is routed through bias network R1, R2 to saturating stage Q1. The collector waveform from Q1 is routed to push-pull output drivers, Q2, Q3. Diodes CR1, CR2 between Q1 collector and load resistor R3 compensate

for the base-to-emitter drop of the output drivers. Series resistors R4 and R5 provide a ground return path. The output is a.c. coupled through C1 to the output. Pulse amplitude must be controlled; control is obtained by the level of voltage directed to collector load R3, established by series regulator Q13, in turn controlled by potentiometer R25.

The operations described above are conducted in the sequence shown on the accompanying function diagram. The complete waveform is shown on the following drawings. A complete detailed schematic of individual circuit cards is included in the following pages. Typical timing relationships for various scanning rates are shown in Table I.

SIGNAL SOURCE 1303
MULTIRATE TV SYNC GENERATOR ACCESSORY
Schematic and Layout Drawing Index

<u>No.</u>	<u>Description</u>
S-3010	Function Diagram
	Electrical Parts List Cover Sheet
PL-2003	Pulse Output
L-2003	Pulse Output
S-2003	Pulse Output
PL-2038	Multirate V Sync
L-2038	Multirate V Sync
S-2038	Multirate V Sync
PL-2036	Dual Mono
L-2036	Dual Mono
S-2036	Dual Mono
PL-2035	Multirate Blank/Control
L-2035	Multirate Blank/Control
S-2035	Multirate Blank/Control
PL-2034	Multirate Crystal
L-2034	Multirate Crystal
S-2034	Multirate Crystal
PL-2039	Multirate Count
L-2039	Multirate Count
S-2039	Multirate Count
PL-2037	Multirate Count Select
L-2037	Multirate Count Select
S-2037	Multirate Count Select
S-3014	Control Panel Wiring



VISUAL INFORMATION INSTITUTE, INC.	
KENIA, CHIC	
FUNCTION DIAGRAM	
MULTIRATE SYNC GENERATOR	
DATE <i>7/4</i>	DATE 8-21-77
S. 2010	

ELECTRICAL PARTS LIST INTRODUCTION

A complete parts list is included in this section for each circuit card and for mechanical parts that contain parts considered replaceable. Repair parts are available from the factory. The following guide to typical suitable, replacement parts may assist in locating the proper part from a more convenient local source.

- RESISTORS Unless otherwise noted, 1/4w. 10% tolerance
IRC Type GBT or equivalent, wattage as noted
on schematic.
- POTENTIOMETERS . . (Board Mounted) Bourns E-Z Trim Type 3067.
Value as noted.
- CAPACITORS a. 1000pf and below - Dipped Mica, CDE Type
CD15-, ARCO Type DM-15-. Value as noted,
+5%.
- b. .001 uf to 0.1 uf - Wrapped Mylar, CDE Type
WMF, 100v. +10%.
- c. 0.1 uf to 10 uf - Solid Tantalum, Sprague
Type 150D - Polarized. +10%, 15v. or higher
voltage rating.
- d. 2 uf to 350 uf - subminiature electrolytic
Sprague Type TE (30D) -10% +150%. Value
and rating as noted.
- e. Above 100 uf - Electrolytic, Polarized,
Sprague Type TVA, "Atom".
- INDUCTORS Variable - 0.44 uh to 350 uh - J. W. Miller
Co., Series 4300.
- Fixed - 0.1 uh to 1000 uh - Nytronics Type DD.
- SEMICONDUCTORS . . Per JEDEC Number 1N--, 2N--, etc.

NOTE: If a circuit card should employ special components not itemized above, they will be completely described on that particular circuit card parts list.

PARTS LIST FOR PULSE OUTPUTDATE 3-2-78

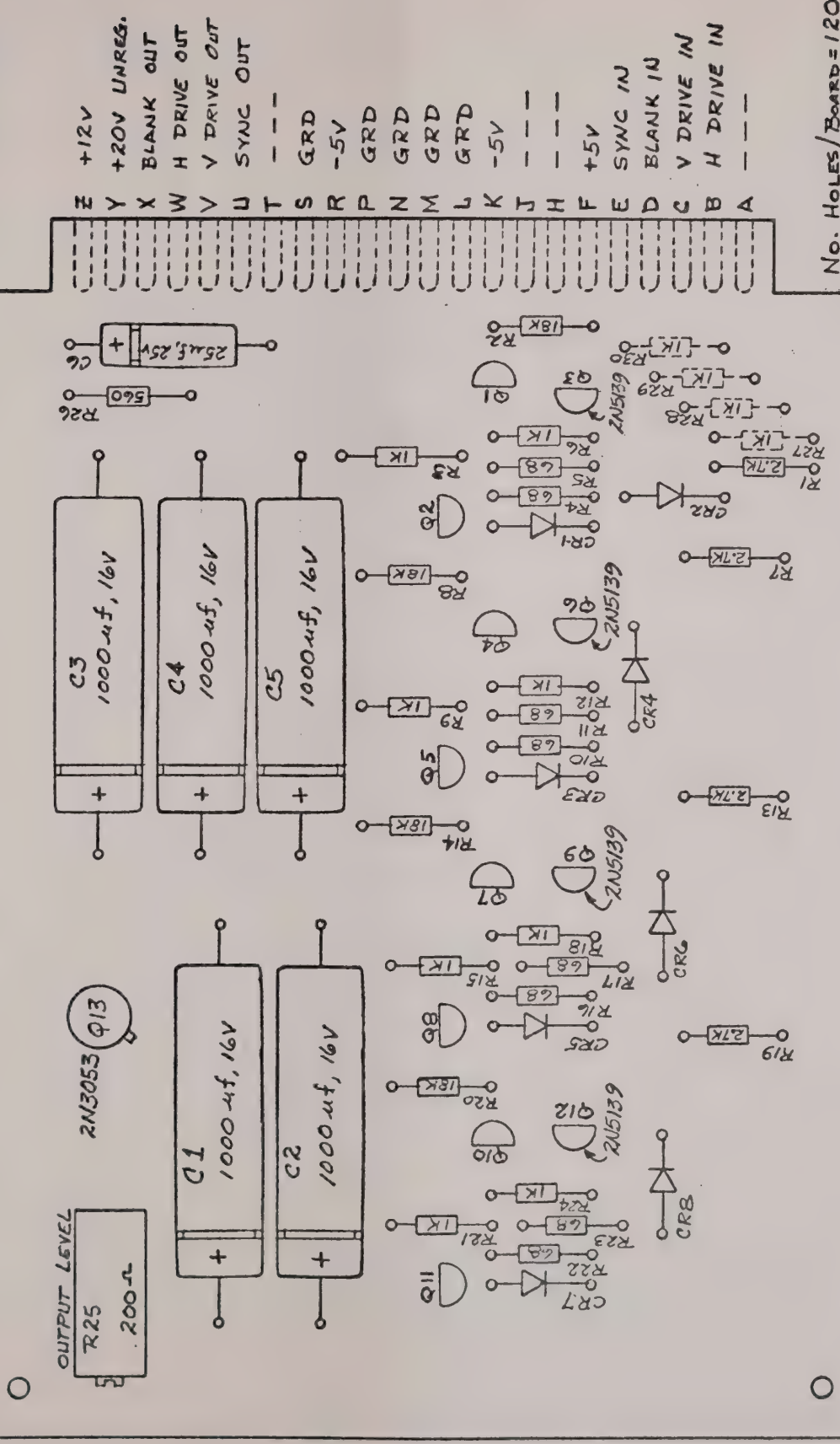
PL-2003

PRINTED CIRCUIT BOARD ASSYARTWORK REV. B (2-78)SHEET 1 OF 1

REF DES	DESCRIPTION	VALUE	QTY	MANUFACTURER	PART No.	PRICE	AMOUNT
	PULSE OUTPUT, P.C. BOARD ASSY		X	Vii	L-2003		\$
	PULSE OUTPUT, P.C. BOARD ASSY		X	Vii	CB-2003		
	DIODES		8	BAS	1N4154		
	TRANSISTOR		1	BAS	2N3053		
	TRANSISTOR		8	BAS	2N5134		
	TRANSISTOR		4	BAS	2N5139		
	RESISTOR, FIXED COMP.	68 OHMS	8	Vii	A-1450		
		560 OHMS	1				
		1K OHMS	8				
		2.7K OHMS	4				
		18K OHMS	4		A-1450		
		200 OHMS	1	Vii	A-1460		
	RESISTOR, VARIABLE						
	CAPACITOR	25uF, 25V	1	Vii	A-1458		
	CAPACITOR	1000uF, 16V	5	Vii	A-1459		
	SELECTED PARTS PER GROUP LISTING:						
	GROUP 1 - R27, R28, R29, R30 (1K OHM) - NOT USED						
	GROUP 2 - R27, R28, R29, R30 (1K OHM) - ATX USED - ADD 4 MORE TO QTY ABOVE						

SEE GROUP
LISTING

3-2-78

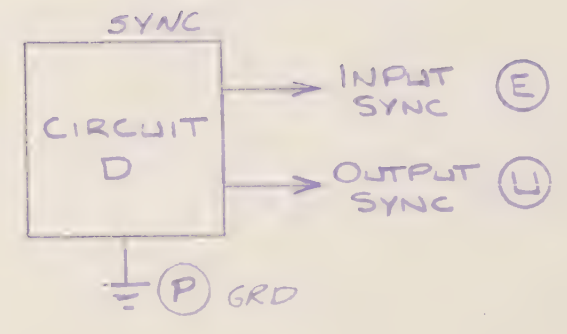
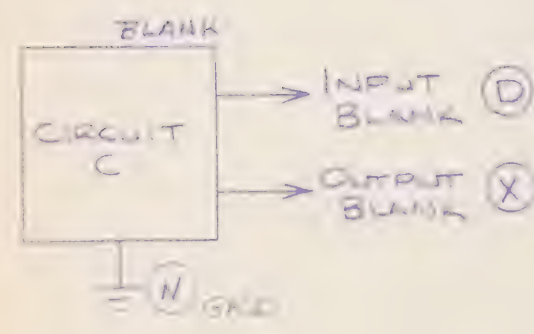
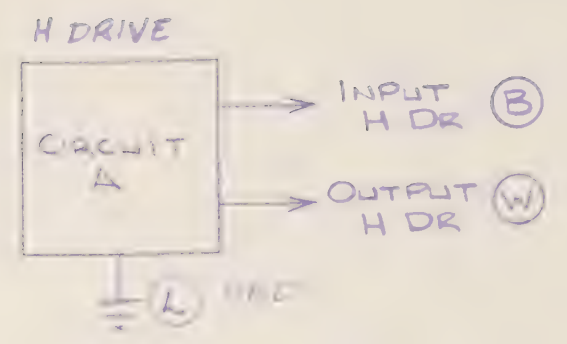
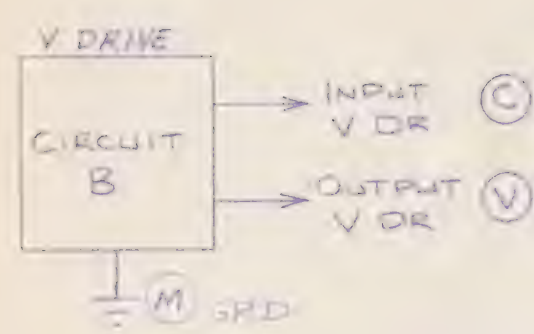
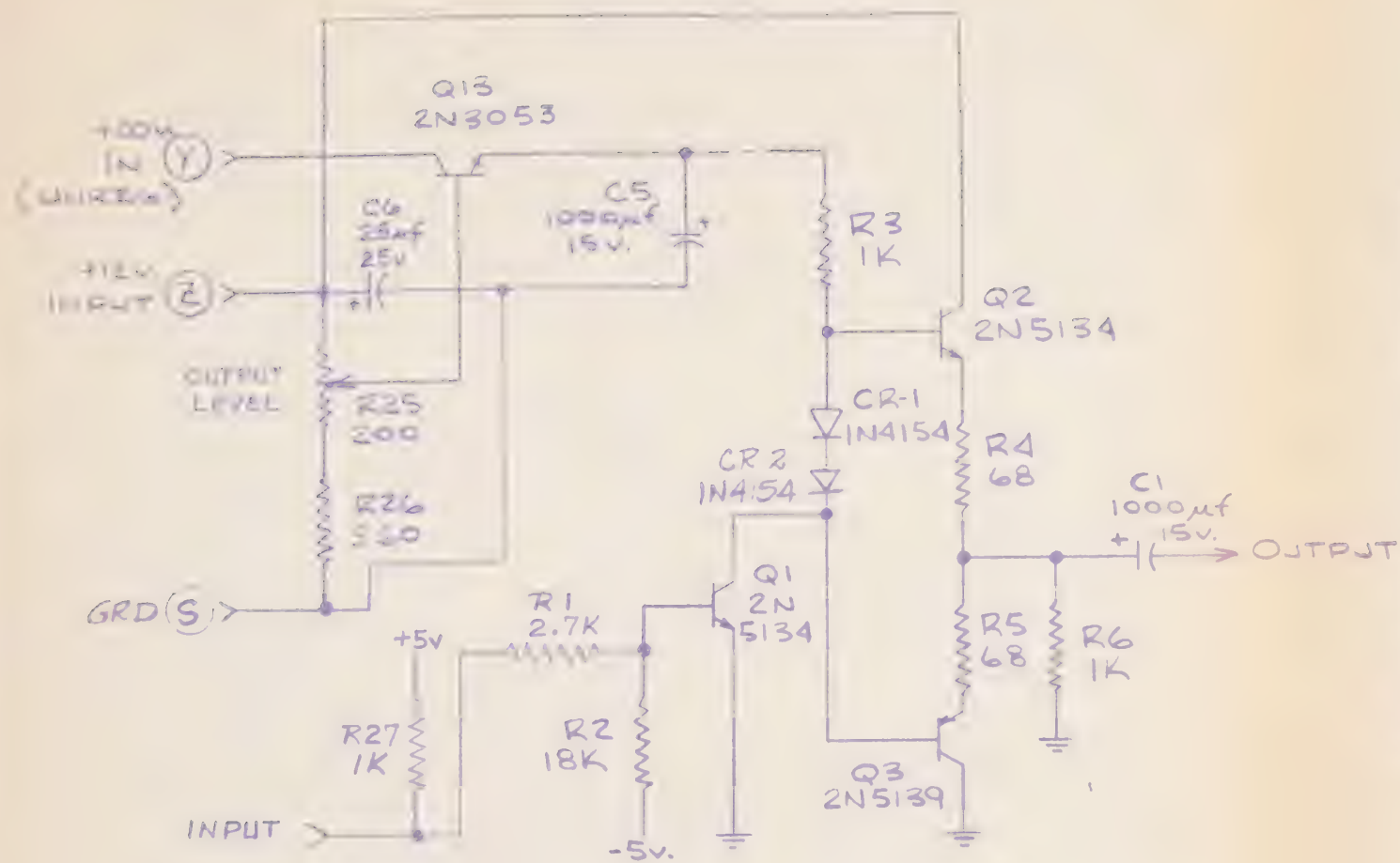


No. HOLES / BOARD = 120

L-2003 PULSE OUTPUT - SYNC SOURCE 1303

WIRING INTERCONNECTIONS

CONNECTOR PIN	FUNCTION	DESTINATION
Z	+12v.	[CHASSIS, TB1, POSITION 3]
Y	+DC	[CHASSIS, TB1, POSITION 2]
X	BLANK OUT	[REAR PANEL, J3, BLANKING]
W	H DRIVE OUT	[REAR PANEL, J1, H DRIVE]
V	V DRIVE OUT	[REAR PANEL, J2, V DRIVE]
U	SYNC OUT	[REAR PANEL, J4, SYNC]
T	--	
S	GROUND	[PULSE OUTPUT, PIN P, PIN N, PIN M, PIN L][GROUND BUSS]
R	-5v.	[-5v. BUSS]
P	GROUND	[PULSE OUTPUT, PIN S, PIN N, PIN M, PIN L][GROUND BUSS]
N	GROUND	[PULSE OUTPUT, PIN S, PIN P, PIN M, PIN L][GROUND BUSS]
M	GROUND	[PULSE OUTPUT, PIN S, PIN P, PIN N, PIN L][GROUND BUSS]
L	GROUND	[PULSE OUTPUT, PIN S, PIN P, PIN N, PIN M][GROUND BUSS]
K	-5v.	[-5v. BUSS]
J	-12v.	[CHASSIS, TB1, POSITION 6]
H	-E	[CHASSIS, TB1, POSITION 5]
F	+5v.	[+5v. BUSS]
E	SYNC IN	[MULTIRATE V SYNC, PIN D]
D	BLANK IN	[MULTIRATE BLANK/CONTROL, PIN R]
C	V DRIVE IN	[MULTIRATE BLANK/CONTROL, PIN U]
B	H DRIVE IN	[MULTIRATE DUAL MONO/H DRIVE & H BLANKING, PIN A]
A	--	



CIRCUIT DETAIL- USED FOUR PLACES

POWER CONNECTIONS-

+12v.	+5v	-5v	GRD
(Z)	(F)	(K)	(S)
		(R)	(P)
			(N)
			(M)
			(L)

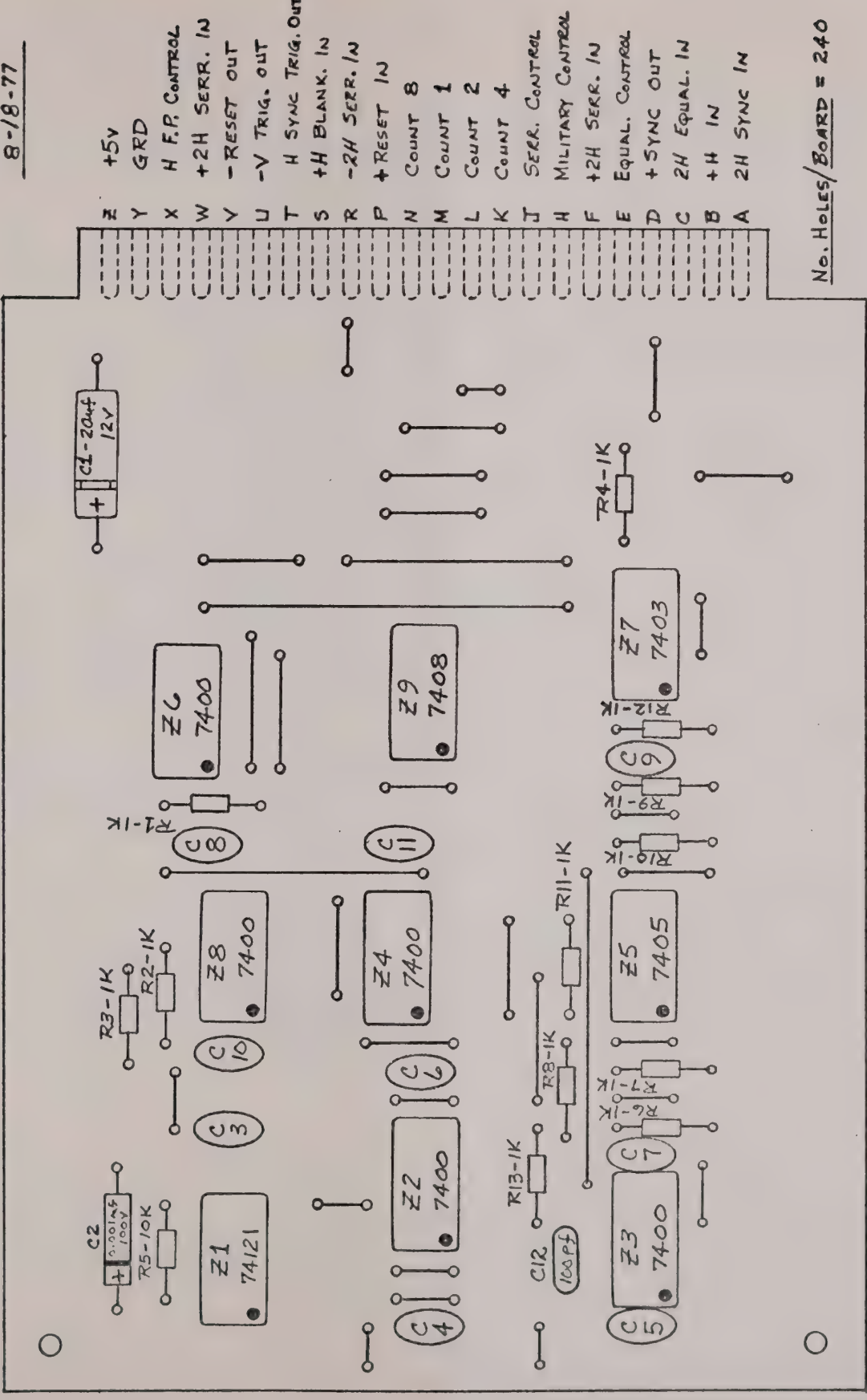
NOTE: 1. RESISTORS 4 w. ± 1.0% tol.
2. R27, R28, R29, & R30 ARE OPTIONAL PER GROUP LISTING, SEE PL-2003 (SHT 1)

VISUAL INFORMATION INSTITUTE, INC. XENIA, OHIO	
PULSE OUTPUT	
DRN: M. BURCH	DATE: 2-25-75
APPD: [Signature]	DATE: 2-15-77
REV: 3-2-78	DIG. NO. 5-3003

PARTS LIST FOR MULTIRATE V SYNC PRINTED CIRCUIT BOARD ASSY

DATE 8-18-77
REV. B (7-77)
PL-2038
SHT 1 of 1

REF DES	DESCRIPTION	VALUE	QTY	MANUFACTURER	PART No.	PRICE	AMOUNT
	MULTIRATE V SYNC-PC BOARD ASSY		X	Vii	L-2038		\$
	MULTIRATE V SYNC-PC B. NETWORK		X	Vii	CB-2038		
	RESISTOR, FIXED COMP.	1K OHM	12	Vii	A-1450		
	RESISTOR, FIXED COMP.	10K OHM	1	Vii	A-1450		
	CAPACITOR	100 pf	1	Vii	A-1454		
	CAPACITOR	0.001uf, 100V	1	Vii	A-1456		
	CAPACITOR	0.1uf, 10V	9	Vii	A-1455		
	CAPACITOR	20uf, 12V	1	Vii	A-1458		
	I.C.		5	BAS	7400		
	I.C.		1	BAS	7403		
	I.C.		1	BAS	7405		
	I.C.		1	BAS	7408		
	I.C.		1	BAS	74121		
	I.C. SOCKET (14 PIN)		9	Vii	A-1465		
	BUS WIRE, #24 AWG, SOLID		AR	BAS			



No. HOLES/BOARD = 240

- NOTES: 1. ALL RESISTORS = $\frac{1}{4}$ W, $\pm 10\%$ Tol.
2. C3 THRU C11 = 0.1uF, 10V
3. 0—0 BUS WIRE, #24 SOLID

WIRING INTERCONNECTIONS

CONNECTOR

PIN	FUNCTION	DESTINATION
Z	+5v.	[+5v. BUSS A]
Y	GROUND	[GROUND BUSS]
X	F.P. CONTROL	[MULTIRATE V SYNC, PIN H][CONTROL PANEL, S2, WAVEFORM]
W	+2H SERR IN	[MULTIRATE V SYNC, PIN F][MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS, PIN A, PIN U]
V	--	
U	-V TRIG IN	[MULTIRATE BLANK/CONTROL, PIN V]
T	H SYNC TRIG	[MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC, PIN F]
S	+H BLANK	[MULTIRATE DUAL MONO/H DRIVE & H BLANKING, PIN Z]
R	-SERR	[MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS, PIN K]
P	+RESET IN	[MULTIRATE COUNT, PIN X][MULTIRATE COUNT SELECT 1, PIN L, PIN H, PIN E] [MULTIRATE COUNT SELECT 2, PIN H, PIN L]
N	COUNT 8	[MULTIRATE COUNT, PIN B][MULTIRATE COUNT SELECT 1, PIN C][MULTIRATE COUNT SELECT 2, PIN P][MULTIRATE COUNT SELECT 3, PIN R]
M	COUNT 1	[MULTIRATE COUNT, PIN K][MULTIRATE COUNT SELECT 2, PIN C, PIN N]
L	COUNT 2	[MULTIRATE COUNT, PIN F][MULTIRATE COUNT SELECT 2, PIN B, PIN M]
K	COUNT 4	[MULTIRATE COUNT, PIN E][MULTIRATE COUNT SELECT 1, PIN B][MULTIRATE COUNT SELECT 2, PIN R][MULTIRATE COUNT SELECT 3, PIN B]
J	SERR	[MULTIRATE V SYNC, PIN E][CONTROL PANEL, S2, SYNC WAVEFORM]
H	MILITARY	[MULTIRATE V SYNC, PIN X][CONTROL PANEL, S2 SYNC WAVEFORM]
F	+2H SERR	[MULTIRATE V SYNC, PIN W][MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS, PIN A, PIN U]
E	EQUAL	[MULTIRATE V SYNC, PIN J][CONTROL PANEL, S2, SYNC WAVEFORM]
D	SYNC OUT	[PULSE OUTPUT, PIN E]
C	2H EQUAL IN	[MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS, PIN R]
B	+H IN	[MULTIRATE COUNT, PIN M]
A	+H SYNC IN	[MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC, PIN A]

PARTS LIST FOR MULTIRATE SYNC DUAL MONO

DATE 7-26-77

PL-2036

PRINTED CIRCUIT BOARD ASSY

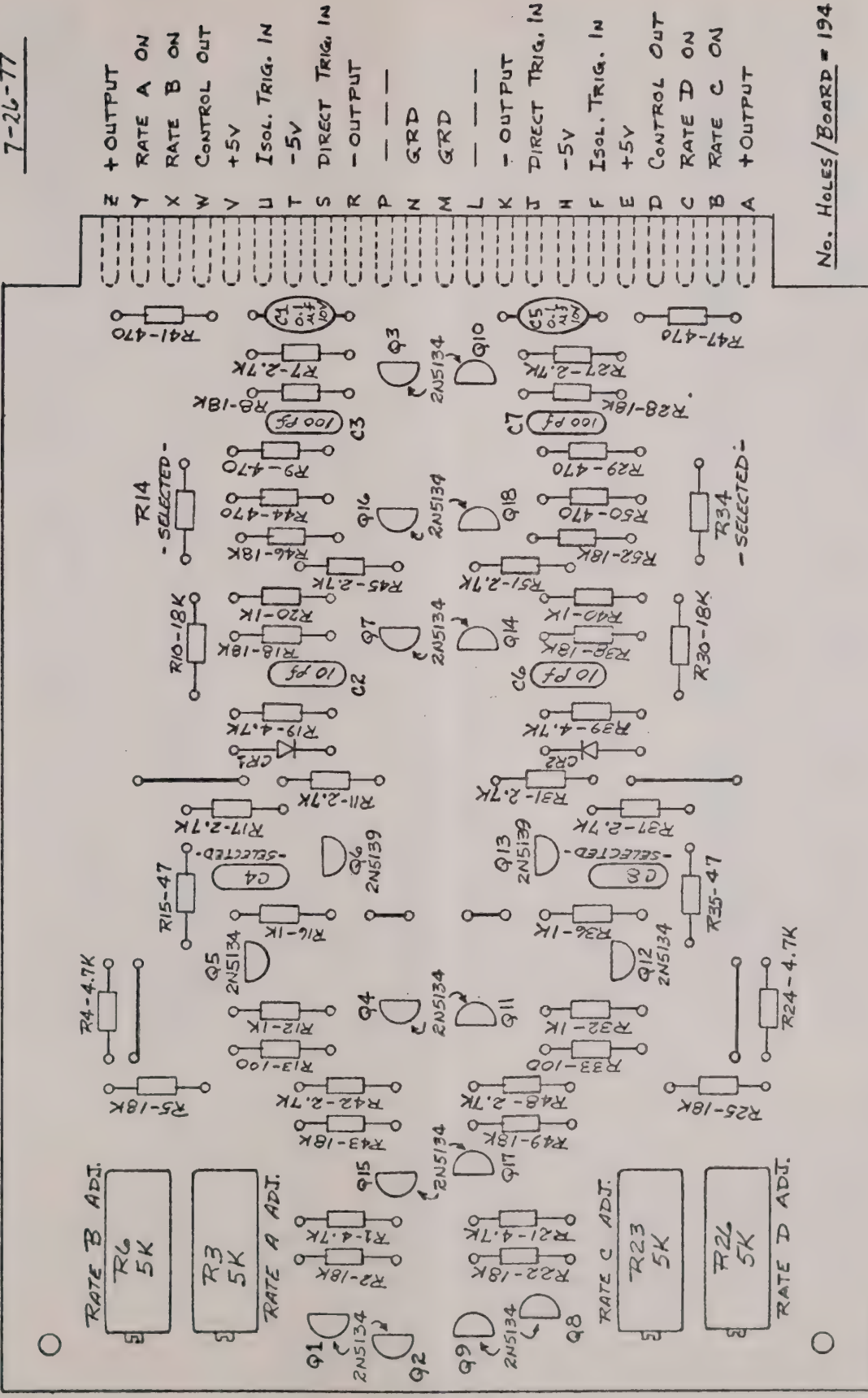
ARTWORK REV. A (7-77)

SHEET 1 of 2

REF DES	DESCRIPTION	VALUE	QTY	MANUFACTURER	PART No.	PRICE	AMOUNT
	MULTIRATE SYNC DUAL MONO - P.C. BOARD ASSY		X	Vii	L-2036		\$
	MULTIRATE SYNC DUAL MONO - P.C. BOARD ARTWORK		X	Vii	CB-2036		
	• DIODE		2	BAS	1N4154		
	• TRANSISTOR		16	BAS	2N5134		
	• TRANSISTOR		2	BAS	2N5139		
	• RESISTOR, FIXED COMP.	47 OHMS	2	Vii	A-1450		
	•	100 OHMS	2				
	•	470 OHMS	6				
	•	1K OHMS	6				
	•	2.7K OHMS	10				
	•	4.7K OHMS	6				
	• RESISTOR, FIXED COMP.	18K OHMS	14		A-1450		
	• RESISTOR, VARIABLE	5K OHMS	4	Vii	A-1460		
	• CAPACITOR	10 pf	2	Vii	A-1454		
	• CAPACITOR	100 pf	2	Vii	A-1454		
	• CAPACITOR	0.1uf, 10V	2	Vii	A-1455		
	• BUS WIRE, #24 AWG SOLID		AR	BAS			

SELECTED PARTS PER GROUP LISTING AS FOLLOWS:

GROUP	APPLICATION	C4	R14	C8	R34	RANGE
1	H FRONT PEGG (3.0-1.0)	200 pf	1.5K OHMS			0.5 - 4.0
	H SYNC (4.75-2.75)			750 pf	3.3K OHMS	2.0 - 5.7
2	2H EQUALIZING (2.35-1.4)	300 pf	2.2K OHMS			0.7 - 3.6
	2H SEERATIONS (4.5-2.0)			300 pf	1.5K OHMS	0.7 - 6.0
3	H BLANKING (11-7)	2200 pf	3.9K OHMS			4.4 - 14
	H DRIVE (6.4-3.5)			750 pf	2.2K OHMS	1.7 - 8.8



No. HOLES/BOARD = 194

- NOTES:
1. ALL RESISTORS = $\frac{1}{4}W, \pm 10\% TOL.$
 2. ALL DIODES = 1N4154
 3. $\bigcirc$ BUS WIRE, #24 SOLID
 4. C4, C8, R14, R34 ARE SELECTED
- PER GROUP LISTING, SEE PL-2036 (SHT 2)

WIRING INTERCONNECTIONS

CONNECTOR

PIN FUNCTION

DESTINATION

Z --

Y LO ON

[MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC, PIN B][MULTIRATE DUAL MONO/
2H EQUALIZING & 2H SERRATIONS, PIN B, PIN Y][MULTIRATE DUAL MONO/H
DRIVE & H BLANKING, PIN B, PIN Y][CONTROL PANEL, S1, SCAN RATE SELECT]

X HI ON

[MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC, PIN C][MULTIRATE DUAL MONO/
2H EQUALIZING & 2H SERRATIONS, PIN X, PIN C][MULTIRATE DUAL MONO/H
DRIVE & H BLANKING, PIN X, PIN C][CONTROL PANEL, S1, SCAN RATE SELECT]

W --

V +5v.

[+5v. BUSS B]

U TRIG IN

[MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS, PIN F][MULTIRATE
COUNT, PIN T]

T -5v.

[-5v. BUSS]

S --

R -F.P. OUT

[MULTIRATE COUNT, PIN R]

P --

N GROUND

[GROUND BUSS]

M --

L --

K --

J --

H -5v.

[-5v. BUSS]

F TRIG IN

[MULTIRATE V SYNC, PIN T]

E +5v.

[+5v. BUSS B]

D --

C HI ON

[MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC, PIN X][MULTIRATE DUAL MONO/
2H EQUALIZING & 2H SERRATIONS, PIN X, PIN C][MULTIRATE DUAL MONO/H
DRIVE & H BLANKING, PIN X, PIN C][CONTROL PANEL, S1, SCAN RATE SELECT]

B LO ON

[MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC, PIN Y][MULTIRATE DUAL MONO/
2H EQUALIZING & 2H SERRATIONS, PIN Y, PIN B][MULTIRATE DUAL MONO/H
DRIVE & H BLANKING, PIN Y, PIN B][CONTROL PANEL, S1, SCAN RATE SELECT]

A +SYNC OUT

[MULTIRATE V SYNC, PIN A]

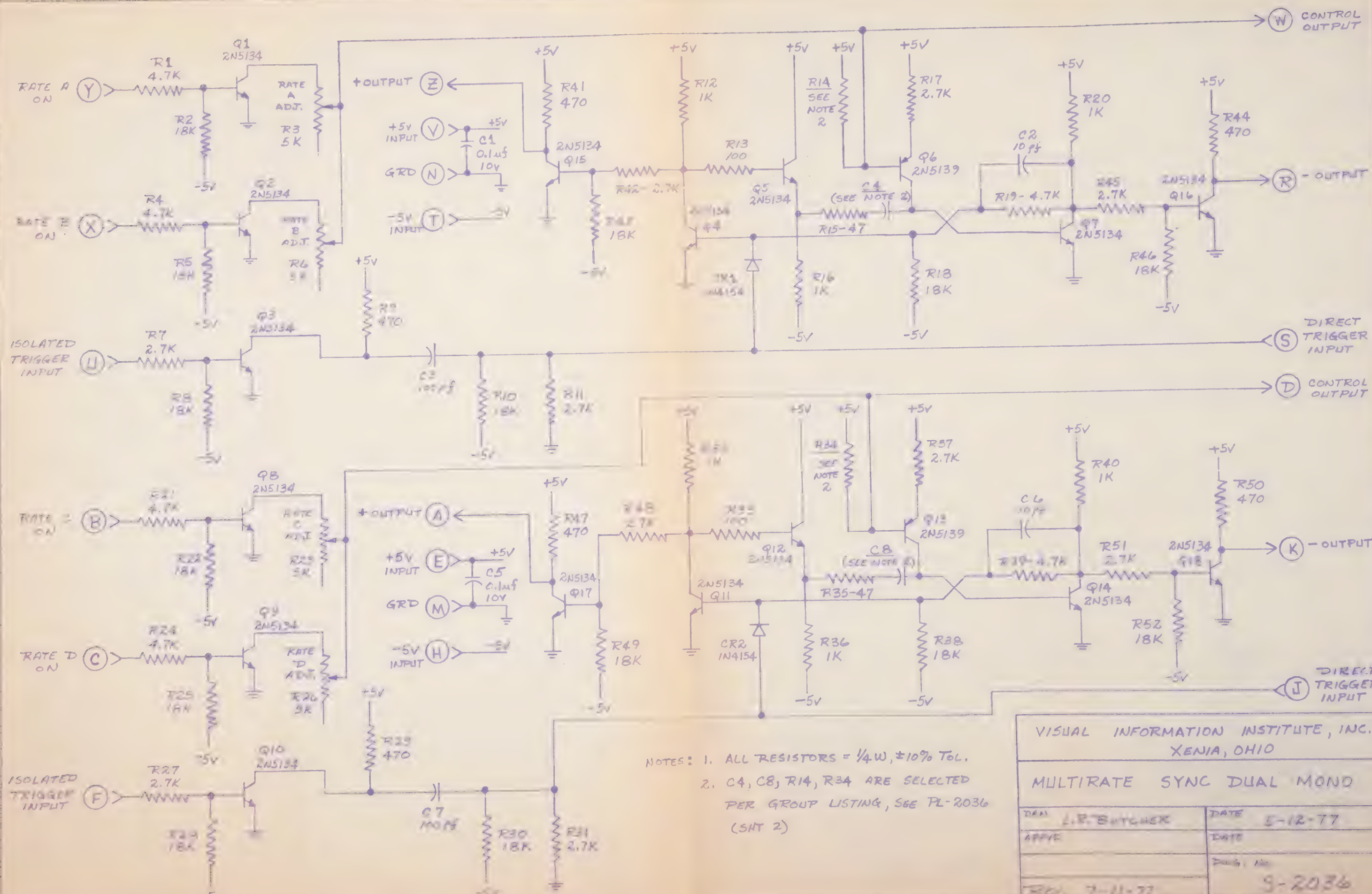
WIRING INTERCONNECTIONS

CONNECTOR PIN	FUNCTION	DESTINATION
Z	--	
Y	LO ON	[MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS, PIN B][MULTIRATE DUAL MONO/H FRONT MONO/H DRIVE & H BLANKING, PIN B, PIN Y][MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC, PIN B, PIN Y][CONTROL PANEL, S1, SCAN RATE SELECT]
X	HI ON	[MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS, PIN C][MULTIRATE DUAL MONO/H DRIVE & H BLANKING, PIN C, PIN X][MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC, PIN X, PIN C][CONTROL PANEL, S1, SCAN RATE SELECT]
W	--	
V	+5v.	[+5v. BUSS B]
U	TRIG IN	[MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS, PIN A][MULTIRATE V SYNC, PIN F, PIN W]
T	-5v.	[-5v. BUSS]
S	--	
R	-EQUAL OUT	[MULTIRATE V SYNC, PIN C]
P	--	
N	GROUND	[GROUND BUSS]
M	--	
L	--	
K	-OUT	[MULTIRATE V SYNC, PIN R]
J	--	
H	-5v.	[-5v. BUSS]
F	TRIG IN	[MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC, PIN U][COLOR SUBCARRIER, PIN L][MULTIRATE COUNT, PIN T]
E	+5v.	[+5v. BUSS B]
D	--	
C	HI ON	[MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS, PIN X][MULTIRATE DUAL MONO/H DRIVE & H BLANKING, PIN X, PIN C][MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC, PIN X, PIN C][CONTROL PANEL, S1, SCAN RATE SELECT]
B	LO ON	[MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS, PIN Y][MULTIRATE DUAL MONO/H DRIVE & H BLANKING, PIN B, PIN Y][MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC, PIN B, PIN Y][CONTROL PANEL, S1, SCAN RATE SELECT]
A	+SERR OUT	[MULTIRATE V SYNC, PIN F, PIN W]

WIRING INTERCONNECTIONS

CONNECTOR

PIN	FUNCTION	DESTINATION
Z	+H BLANK OUT	[MULTIRATE V SYNC, PIN S]
Y	LO ON	[MULTIRATE DUAL MONO/H DRIVE & H BLANKING, PIN B][MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS, PIN Y, PIN B][MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC, PIN Y, PIN B][CONTROL PANEL, S1, SCAN RATE SELECT]
X	HI ON	[MULTIRATE DUAL MONO/H DRIVE & H BLANKING, PIN C][MULTIRATE DUAL MONO/2H EQUALIZING & 2H SERRATIONS, PIN X, PIN C][MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC, PIN X, PIN C][CONTROL PANEL, S1, SCAN RATE SELECT]
W	--	
V	+5v.	[+5v. BUSS B]
U	TRIG IN	[MULTIRATE DUAL MONO/H DRIVE & H BLANKING, PIN F][MULTIRATE COUNT, PIN N]
T	-5v.	[-5v. BUSS]
S	--	
R	-BLANK OUT	[MULTIRATE BLANK/CONTROL, PIN P]
P	--	
N	GROUND	[GROUND BUSS]
M	--	
L	--	
K	--	
J	--	
H	-5v.	[-5v. BUSS]
F	TRIG IN	[MULTIRATE DUAL MONO/H DRIVE & H BLANKING, PIN U][MULTIRATE COUNT, PIN N]
E	+5v.	[+5v. BUSS B]
D	--	
C	HI ON	[MULTIRATE DUAL MONO/H DRIVE & H BLANKING, PIN X][MULTIRATE DUAL MONO/ 2H EQUALIZING & 2H SERRATIONS, PIN X, PIN C][MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC, PIN X, PIN C][CONTROL PANEL, S1, SCAN RATE SELECT]
B	LO ON	[MULTIRATE DUAL MONO/H DRIVE & H BLANKING, PIN Y][MULTIRATE DUAL MONO/ 2H EQUALIZING & 2H SERRATIONS, PIN Y, PIN B][MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC, PIN Y, PIN B][CONTROL PANEL, S1, SCAN RATE SELECT]
A	+H DR OUT	[PULSE OUTPUT, PIN B]



NOTES: 1. ALL RESISTORS = $\frac{1}{4}$ W, $\pm 10\%$ Tol.
 2. C4, C8, R14, R34 ARE SELECTED PER GROUP LISTING, SEE PL-2036 (SHT 2)

VISUAL INFORMATION INSTITUTE, INC. XENIA, OHIO	
MULTIRATE SYNC DUAL MONO	
DESIGN L.R. BUTCHER	DATE 5-12-77
APPROVE	DATE
REV. 7-11-77	9-2036

PARTS LIST FOR MULTIRATE BLANK/CONTROL PRINTED CIRCUIT BOARD ASSY

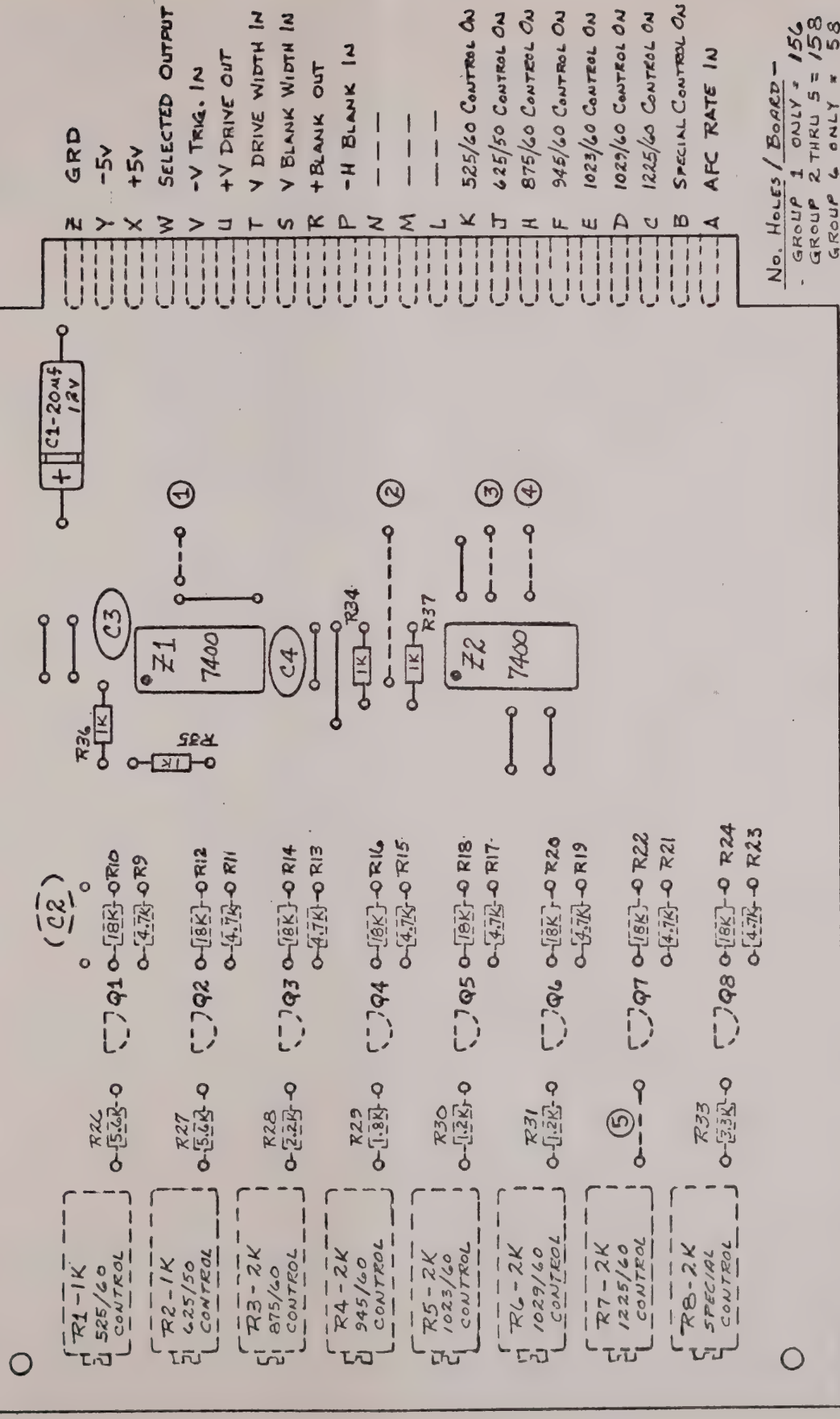
DATE 8-28-78
ARTWORK REV. B (7-77)

PL-2035
SHT 1 of 2

REF ID	DESCRIPTION	VALUE	QTY	MANUFACTURER	PART No.	PRICE	AMOUNT
	MULTIRATE BLANK/CONTROL, P.C.B. ASSY		X	Vii	L-2035		45
	MULTIRATE BLANK/CONTROL, P.C.B. ARTWORK		X	Vii	CB-2035		
	TRANSISTOR		8	BAS	2N5134		
	RESISTOR, FIXED COMPL	1K OHMS	4	Vii	A-1450		
		1.2K OHMS	2				
		1.8K OHMS	1				
		2.2K OHMS	1				
		3.3K OHMS	1				
		4.7K OHMS	8				
		5.6K OHMS	2				
	RESISTOR, FIXED COMPL	18K OHMS	8		A-1450		
	RESISTOR, VARIABLE	1K OHMS	2		A-1460		
	RESISTOR, VARIABLE	2K OHMS	6	Vii	A-1460		
	CAPACITOR	0.1uf, 10V	3	Vii	A-1455		
	CAPACITOR	20uf, 12V	1	Vii	A-1458		
	I.C.		2	BAS	7400		
	I.C. SOCKET (14PIN)		2	Vii	A-1465		
	BUS WIRE, #24 SOLID		AR	BAS			

PARTS SELECTION PER GROUP LISTING :

GROUP	DESCRIPTION
1	Do Not Use JUMPERS ①, ②, ③, ④ — No OUTPUT AT PIN W — Do Use JUMPER ⑤
2	USE JUMPER ① & ⑤ ONLY — PIN W = -V DRIVE OUTPUT — Do Not Use JUMPERS ②, ③, ④
3	USE JUMPER ② & ⑤ ONLY — PIN W = -BLANKING OUTPUT — Do Not Use JUMPERS ①, ③, ④
4	USE JUMPER ③ & ⑤ ONLY — PIN W = -V BLANKING OUTPUT — Do Not Use JUMPERS ①, ②, ④
5	USE JUMPER ④ & ⑤ ONLY — PIN W = +V BLANKING OUTPUT — Do Not Use JUMPERS ①, ②, ③
6	Do Not Use JUMPERS ①, ②, ③, ④, ⑤; Do Not Use R1 THRU R33, ⑧1 THRU ⑧8, OR C2



- NOTES: 1. ALL RESISTORS = $\frac{1}{4}W, \pm 10\% \text{ Tol.}$
 2. C2, C3, $fC4 = 0.1\mu f, 10V$
 3. ALL TRANSISTORS = 2N1513A
 4. $\bigcirc$ — 0 BUS WIRE, #24 SOLID
 5. R25 & R32 NOT USED

L-2035 MULTIRATE BLANK/CONTROL - SYNC SOURCE 1303

WIRING INTERCONNECTIONS

CONNECTOR PIN	FUNCTION	DESTINATION
Z	GROUND	[GROUND BUSS]
Y	-5v.	[-5v. BUSS]
X	+5v.	[+5v. BUSS]
W	--	
V	-V TRIG	[MULTIRATE V SYNC, PIN U]
U	+V DR OUT	[PULSE OUTPUT, PIN C]
T	V DR WIDTH	[MULTIRATE COUNT SELECT 3, PIN E, PIN H]
S	V BLANK WIDTH	[MULTIRATE COUNT SELECT 2, PIN E][MULTIRATE COUNT SELECT 3, PIN L]
R	+BLANK OUT	[PULSE OUTPUT, PIN D]
P	-H BLANK	[MULTIRATE DUAL MONO/H DRIVE & H BLANKING, PIN R]
N	--	
M	--	
L	--	
K	--	
J	--	
H	--	
F	--	
E	--	
D	--	
C	--	
B	--	
A	--	

REF DES	DESCRIPTION	VALUE	QTY	MANUFACTURER	PART No.	PRICE	AMOUNT
	MULTIRATE CRYSTAL M.O. - P.C. BOARD ASSY		X	Vii	L-2034		\$
	MULTIRATE CRYSTAL M.O. - P.C. BOARD ATTACHMENT		X	Vii	CB-2034		
	TRANSISTOR		9	BAS	2N5134		
	RESISTOR, FIXED COMP.	2.2K OHMS	9	Vii	A-1450		
	RESISTOR, FIXED COMP.	18K OHMS	9	Vii	A-1450		
	CAPACITOR	0.01uf, 16V	8	Vii	A-1455		
	CAPACITOR	0.1uf, 10V	16	Vii	A-1455		
	CAPACITOR	20uf, 12V	1	Vii	A-1458		
	I.C.		8	BAS	MC12060P		
	I.C. SOCKET (16 PIN)		8	Vii	A-1465		
	CRYSTAL HOLDER		8	BAS			
	SCREW, PAN HEAD	#2-56 X 3/16 LG	16	BAS			
	NUT - HEX	#2-56 THD	16	BAS			
	CRYSTAL - SELECTED PER SCAN RATE, SEE PL-2034 (SHEET 2)						
	BUS WIRE, #24 AWG SOLID		AR	BAS			

PARTS LIST FOR MULTIRATE CRYSTAL N.O.

PRINTED CIRCUIT BOARD ASSY

DATE 8-1-78

NETWORK REV. A (6-77)

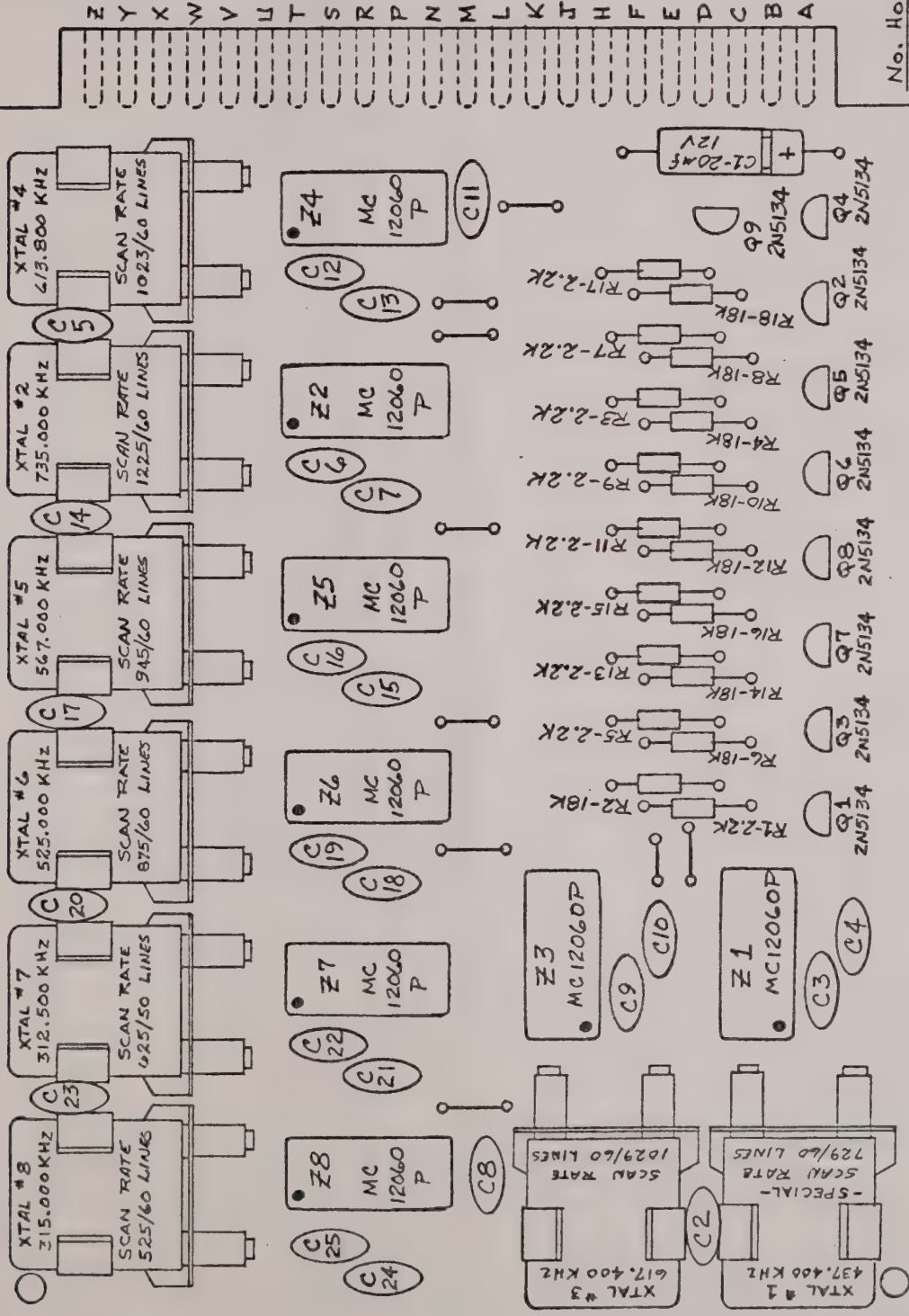
PL- 2034

SHT 2 of 2

CRYSTAL SELECTION PER SCAN RATE AS FOLLOWS:

SCAN RATE	CRYSTAL FREQUENCY
525/60	315.000 KHz
625/50	312.500 KHz
729/60	437.400 KHz
875/60	525.000 KHz
945/60	567.000 KHz
1023/60	613.800 KHz
1029/60	617.400 KHz
1225/60	735.000 KHz

8-1-78



No. Holes/Board = 275

NOTES: 1. ALL RESISTORS = $\frac{1}{4}W, \pm 10\% Tol.$

2. C2, C4, C5, C7, C8, C10, C11, C13, C14, C15,

$C17, C18, C20, C21, C23, C24 = 0.1\mu f @ 10V$

3. C3, C4, C9, C12, C16, C19, C22, C25 = 0.01 μ f @ 16V

4. 0—0 BUS WIRE, #24 SOLID

L-2034 MULTIRATE CRYSTAL - SYNC SOURCE 1303

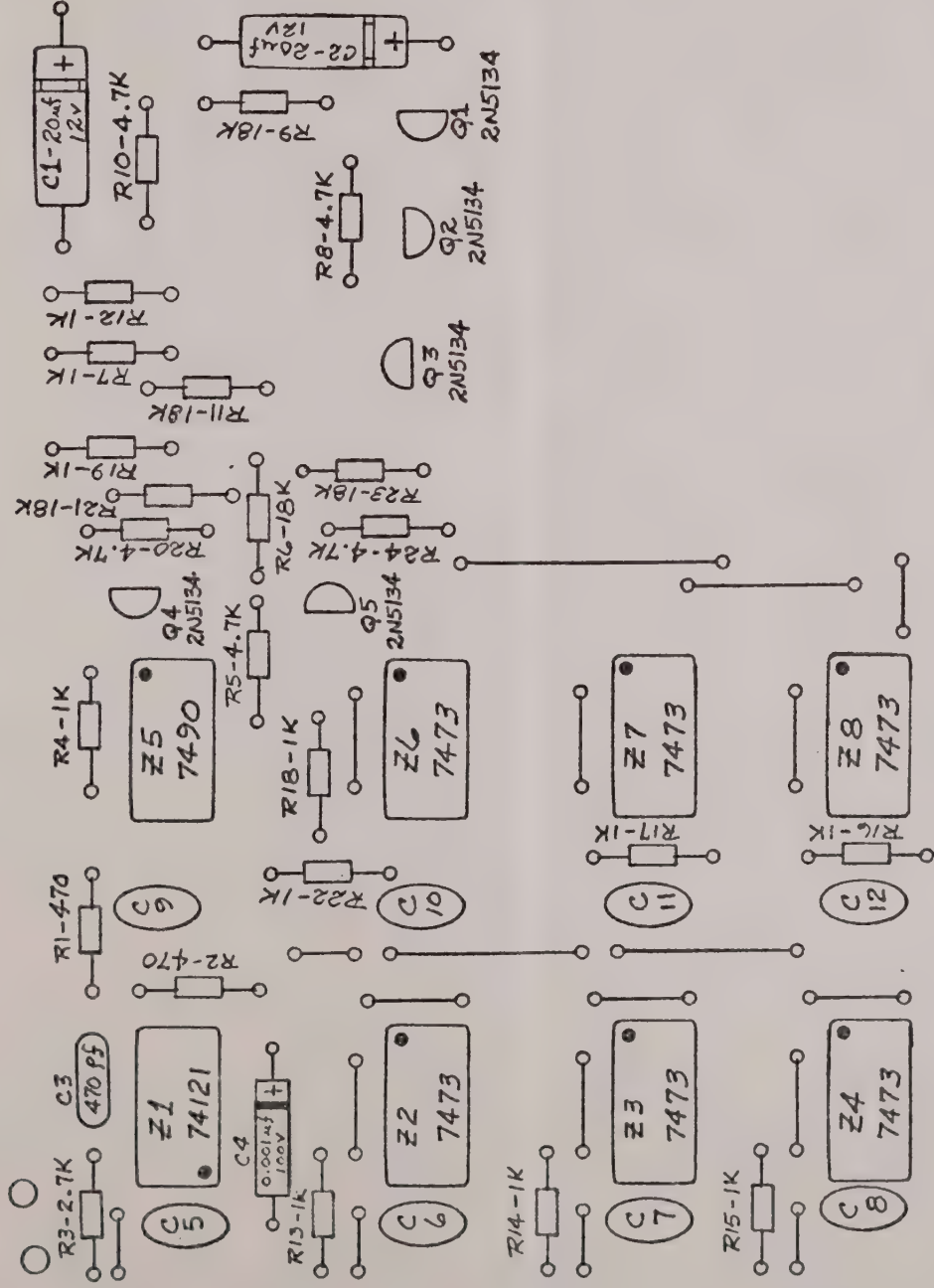
WIRING INTERCONNECTIONS

CONNECTOR

PIN	FUNCTION	DESTINATION
Z	--	
Y	525	[CONTROL PANEL, S1, SCAN RATE SELECT]
X	625	[CONTROL PANEL, S1, SCAN RATE SELECT]
W	875	[CONTROL PANEL, S1, SCAN RATE SELECT]
V	945	[CONTROL PANEL, S1, SCAN RATE SELECT]
U	--	
T	--	
S	--	
R	--	
P	--	
N	--	
M	1023	[CONTROL PANEL, S1, SCAN RATE SELECT]
L	1029	[CONTROL PANEL, S1, SCAN RATE SELECT]
K	1225	[CONTROL PANEL, S1, SCAN RATE SELECT]
J	--	
H	--	
F	-5v.	[-5v. BUSS]
E	SPECIAL	[CONTROL PANEL, S1, SCAN RATE SELECT]
D	--	
C	20H OUT	[MULTIRATE COUNT, PIN W]
B	--	
A	GROUND	[GROUND BUSS]

PARTS LIST FOR MULTIRATE SYNC COUNT
PRINTED CIRCUIT BOARD ASSY

REF DES	DESCRIPTION	VALUE	QTY	MANUFACTURER	PART No.	PRICE	AMOUNT
	MULTIRATE SYNC COUNT - P.C. BOARD ASSY		X	Vii	L-2039		\$
	MULTIRATE SYNC COUNT - P.C.B. RETURN		X	Vii	CB-2039		
	TRANSISTOR		5	BAS	2N5134		
	RESISTOR, FIXED COMP.	470 OHM	2	Vii	A-1450		
	RESISTOR, FIXED COMP.	1K OHM	11	Vii	A-1450		
		2.7K OHM	1				
		4.7K OHM	5				
	RESISTOR, FIXED COMP.	18K OHM	5	Vii	A-1450		
	CAPACITOR	470 Pf	1	Vii	A-1454		
		0.001uf, 100V	1		A-1456		
		0.1uf, 10V	8		A-1455		
	CAPACITOR	20uf, 12V	2	Vii	A-1458		
	I.C.		6	BAS	7473		
	I.C.		1	BAS	7490		
	I.C.		1	BAS	74121		
	I.C. SOCKET (14 PIN)		8	Vii	A-1465		
	BUS WIRE, #24 AWG, SOLID		AR	BAS			



No. HOLES/BOARD = 237

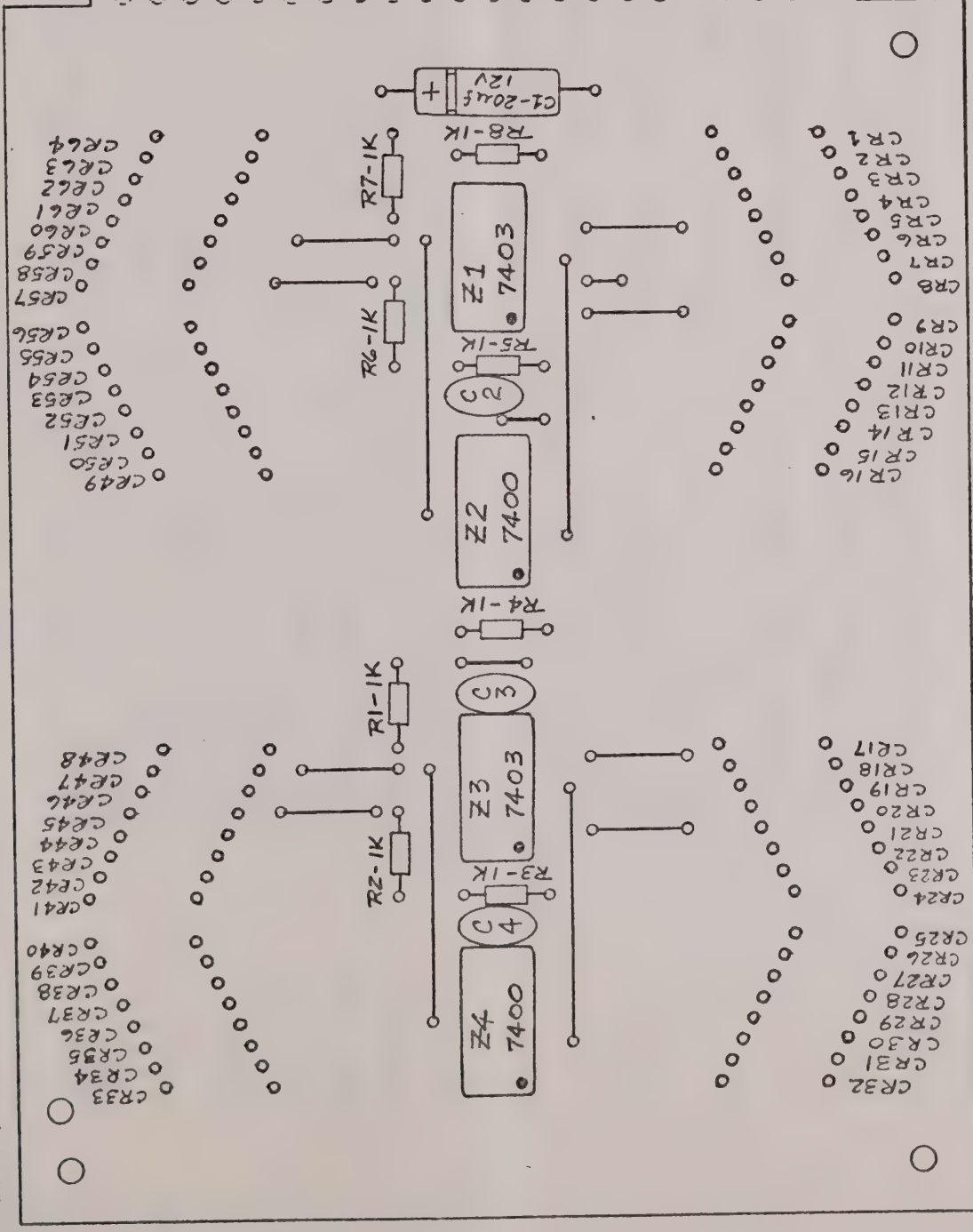
- NOTES: 1. ALL RESISTORS = $\frac{1}{4}$ W, $\pm 10\%$ Tol.
2. C5 THRU C12 = 0.1 μ f, 10V
3. 0—0 BUS WIRE, #24 SOLID

L-2039 MULTIRATE COUNT - SYNC SOURCE 1303

WIRING INTERCONNECTIONS

CONNECTOR PIN	FUNCTION	DESTINATION
Z	+5v.	[+5v. BUSS]
Y	GROUND	[MULTIRATE COUNT, PIN S][GROUND BUSS]
X	+RESET IN	[MULTIRATE COUNT SELECT 1, PIN L, PIN H, PIN E][MULTIRATE COUNT SELECT 2, PIN H, PIN L][MULTIRATE V SYNC, PIN R]
W	20H IN	[MULTIRATE CRYSTAL, PIN C]
V	--	
U	-5v.	[-5v. BUSS]
T	2H OUT	[MULTIRATE DUAL MONO/2H EQUALIZIN & 2H SERRATIONS][MULTIRATE DUAL MONO/ H FRONT PORCH & H SYNC, PIN U]
S	GROUND	[MULTIRATE COUNT, PIN Y][GROUND BUSS]
R	2H IN	[MULTIRATE DUAL MONO/H FRONT PORCH & H SYNC, PIN R]
P	COUNT 512	[MULTIRATE COUNT SELECT 1, PIN R]
N	-H OUT	[MULTIRATE DUAL MONO/H DRIVE & H BLANKING, PIN F, PIN U]
M	+H OUT	[MULTIRATE V SYNC, PIN B]
L	COUNT 0.5	[MULTIRATE COUNT SELECT 2, PIN D, PIN F]
K	COUNT 1	[MULTIRATE COUNT SELECT 2, PIN C, PIN N][MULTIRATE V SYNC, PIN M]
J	COUNT 128	[MULTIRATE COUNT SELECT 1, PIN N]
H	COUNT 256	[MULTIRATE COUNT SELECT 1, PIN P]
F	COUNT 2	[MULTIRATE COUNT SELECT 2, PIN B, PIN M][MULTIRATE V SYNC, PIN L]
E	COUNT 4	[MULTIRATE COUNT SELECT 1, PIN B][MULTIRATE COUNT SELECT 2, PIN R] [MULTIRATE COUNT SELECT 3, PIN B][MULTIRATE V SYNC, PIN K]
D	COUNT 32	[MULTIRATE COUNT SELECT 1, PIN F][MULTIRATE COUNT SELECT 3, PIN M]
C	COUNT 64	[MULTIRATE COUNT SELECT 1, PIN M]
B	COUNT 8	[MULTIRATE COUNT SELECT 1, PIN C][MULTIRATE COUNT SELECT 2, PIN P] [MULTIRATE COUNT SELECT 3, PIN R][MULTIRATE V SYNC, PIN N]
A	COUNT 16	[MULTIRATE COUNT SELECT 1, PIN D][MULTIRATE COUNT SELECT 2, PIN N, PIN P]

REF DES	DESCRIPTION	VALUE	QTY	MANUFACTURER	PART No.	PRICE	AMOUNT
	MULTIRATE COUNT SELECT-PC BOARD ASSY		X	Vii	L-2037		\$
	MULTIRATE COUNT SELECT-PC B. DETAIL		X	Vii	CB-2037		
	DIODE (As Req'd / GROUP LISTING; SEE SHT 2)		X	BAS	1N4154		
	RESISTOR, FIXED COMP.	1K OHM	8	Vii	A-1450		
	CAPACITOR	0.1uf, 10V	3	Vii	A-1455		
	CAPACITOR	20uf, 12V	1	Vii	A-1458		
	I.C.		2	BAS	7400		
	I.C.		2	BAS	7403		
	I.C. SOCKET (14 PIN)		4	Vii	A-1465		
	BUS WIRE, #24AWG SOLID		AR	BAS			



- NOTES: 1. ALL RESISTORS = 1/4W, ±10% Tol.
2. CR2, CR3, CR4 = 0.1µf, 10V
3. ALL DIODES = IN4154
4. ○—○ BUS WIRE, #24 SOLID

5. DIODES (CR1 THRU CR64) ARE
SELECTED PER GROUP LISTING,
SEE PL-2037 (SHT 2)

Z	525/60
Y	625/50
X	875/60
W	945/60
V	1023/60
U	1029/60
T	1225/60
S	SPECIAL
R	COUNT IN
P	COUNT IN
N	COUNT IN
M	COUNT IN
L	RESET (3) out
K	+5V
J	GRD
H	RESET (2) out
F	COUNT IN
E	RESET (1) out
D	COUNT IN
C	COUNT IN
B	COUNT IN
A	INTERLACE CONTROL

No. HOLES/BOARD
-GROUP 1 = 172
-GROUP 2 = 182
-GROUP 3 = 172
-GROUP 4 = 198

I-2037 MULTIRATE COUNT SELECT 1 - SYNC SOURCE 1303

WIRING INTERCONNECTIONS

CONNECTOR PIN	FUNCTION	DESTINATION
Z	525	[MULTIRATE COUNT SELECT 2, PIN Z][MULTIRATE COUNT SELECT 3, PIN Z] [CONTROL PANEL, S1, SCAN RATE SELECT]
Y	625	[MULTIRATE COUNT SELECT 2, PIN Y][MULTIRATE COUNT SELECT 3, PIN Y] [CONTROL PANEL, S1, SCAN RATE SELECT]
X	875	[MULTIRATE COUNT SELECT 2, PIN X][MULTIRATE COUNT SELECT 3, PIN X] [CONTROL PANEL, S1, SCAN RATE SELECT]
W	945	[MULTIRATE COUNT SELECT 2, PIN W][MULTIRATE COUNT SELECT 3, PIN W] [CONTROL PANEL, S1, SCAN RATE SELECT]
V	1023	[MULTIRATE COUNT SELECT 2, PIN V][MULTIRATE COUNT SELECT 3, PIN V] [CONTROL PANEL, S1, SCAN RATE SELECT]
U	1029	[MULTIRATE COUNT SELECT 2, PIN U][MULTIRATE COUNT SELECT 3, PIN U] [CONTROL PANEL, S1, SCAN RATE SELECT]
T	1225	[MULTIRATE COUNT SELECT 2, PIN T][MULTIRATE COUNT SELECT 3, PIN T] [CONTROL PANEL, S1, SCAN RATE SELECT]
S	SPECIAL	[MULTIRATE COUNT SELECT 2, PIN S][MULTIRATE COUNT SELECT 3, PIN S] [CONTROL PANEL, S1, SCAN RATE SELECT]
R	COUNT 512	[MULTIRATE COUNT, PIN P]
P	COUNT 256	[MULTIRATE COUNT, PIN H]
N	COUNT 128	[MULTIRATE COUNT, PIN J]
M	COUNT 64	[MULTIRATE COUNT, PIN C]
L	RESET 2	[MULTIRATE COUNT SELECT 1, PIN H, PIN E][MULTIRATE COUNT SELECT 2, PIN H, PIN L][MULTIRATE COUNT, PIN X][MULTIRATE V SYNC, PIN P]
K	+5v.	[+5v. BUSS]
J	GROUND	[GROUND BUSS]
H	RESET 1	[MULTIRATE COUNT SELECT 1, PIN E, PIN L][MULTIRATE COUNT SELECT 2, PIN H, PIN L][MULTIRATE COUNT, PIN X][MULTIRATE V SYNC, PIN P]
F	COUNT 32	[MULTIRATE COUNT, PIN D][MULTIRATE COUNT SELECT 3, PIN M]
E	RESET 5	[MULTIRATE COUNT SELECT 1, PIN H, PIN L][MULTIRATE COUNT SELECT 2, PIN H, PIN L][MULTIRATE COUNT, PIN X][MULTIRATE V SYNC, PIN P]
D	COUNT 16	[MULTIRATE COUNT, PIN A][MULTIRATE COUNT SELECT 3, PIN N, PIN P]

L-2037 MULTIRATE COUNT SELECT 1 - SYNC SOURCE 1303 (cont.)

WIRING INTERCONNECTIONS

CONNECTOR PIN	FUNCTION	DESTINATION
C	COUNT 8	[MULTIRATE COUNT, PIN B][MULTIRATE COUNT SELECT 2, PIN P][MULTIRATE COUNT SELECT 3, PIN R][MULTIRATE V SYNC, PIN N]
B	COUNT 4	[MULTIRATE COUNT, PIN E][MULTIRATE COUNT SELECT 2, PIN R][MULTIRATE COUNT SELECT 3, PIN B][MULTIRATE V SYNC, PIN K]
A	--	

WIRING INTERCONNECTIONS

CONNECTOR
PIN

FUNCTION

DESTINATION

Z	525	[MULTIRATE COUNT SELECT 3, PIN Z][MULTIRATE COUNT SELECT 1, PIN Z] [CONTROL PANEL, S1, SCAN RATE SELECT]
Y	625	[MULTIRATE COUNT SELECT 3, PIN Y][MULTIRATE COUNT SELECT 1, PIN Y] [CONTROL PANEL, S1, SCAN RATE SELECT]
X	875	[MULTIRATE COUNT SELECT 3, PIN X][MULTIRATE COUNT SELECT 1, PIN X] [CONTROL PANEL, S1, SCAN RATE SELECT]
W	945	[MULTIRATE COUNT SELECT 3, PIN W][MULTIRATE COUNT SELECT 1, PIN W] [CONTROL PANEL, S1, SCAN RATE SELECT]
V	1023	[MULTIRATE COUNT SELECT 3, PIN V][MULTIRATE COUNT SELECT 1, PIN V] [CONTROL PANEL, S1, SCAN RATE SELECT]
U	1029	[MULTIRATE COUNT SELECT 3, PIN U][MULTIRATE COUNT SELECT 1, PIN U] [CONTROL PANEL, S1, SCAN RATE SELECT]
T	1225	[MULTIRATE COUNT SELECT 3, PIN T][MULTIRATE COUNT SELECT 1, PIN T] [CONTROL PANEL, S1, SCAN RATE SELECT]
S	SPECIAL	[MULTIRATE COUNT SELECT 3, PIN S][MULTIRATE COUNT SELECT 1, PIN S] [CONTROL PANEL, S1, SCAN RATE SELECT]
R	COUNT 4	[MULTIRATE COUNT SELECT 3, PIN B][MULTIRATE COUNT SELECT 1, PIN B] [MULTIRATE COUNT, PIN E][MULTIRATE V SYNC, PIN K]
P	COUNT 8	[MULTIRATE COUNT SELECT 3, PIN R][MULTIRATE COUNT SELECT 1, PIN C] [MULTIRATE COUNT, PIN B][MULTIRATE V SYNC, PIN N]
N	COUNT 1	[MULTIRATE COUNT SELECT 2, PIN C][MULTIRATE COUNT, PIN K][MULTIRATE V SYNC, PIN M]
M	COUNT 2	[MULTIRATE COUNT SELECT 2, PIN B][MULTIRATE COUNT, PIN F][MULTIRATE V SYNC, PIN L]
L	RESET 2	[MULTIRATE COUNT SELECT 2, PIN H][MULTIRATE COUNT SELECT 1, PIN E, PIN H, PIN L][MULTIRATE COUNT, PIN X][MULTIRATE V SYNC, PIN P]
K	+5v.	[+5v. BUSS]
J	GROUND	[GROUND BUSS]
H	RESET 1	[MULTIRATE COUNT SELECT 2, PIN L][MULTIRATE COUNT SELECT 1, PIN E, PIN H, PIN L][MULTIRATE COUNT, PIN X][MULTIRATE V SYNC, PIN P]

WIRING INTERCONNECTIONS

CONNECTOR PIN	FUNCTION	DESTINATION
F	COUNT 0.5	[MULTIRATE COUNT SELECT 2, PIN D][MULTIRATE COUNT SELECT 3, PIN F] [MULTIRATE COUNT, PIN L]
E	RESET 5	[MULTIRATE COUNT SELECT 3, PIN L][MULTIRATE BLANK/CONTROL, PIN S]
D	COUNT 0.5	[MULTIRATE COUNT SELECT 2, PIN F][MULTIRATE COUNT SELECT 3, PIN F] [MULTIRATE COUNT, PIN L]
C	COUNT 1	[MULTIRATE COUNT SELECT 2, PIN N][MULTIRATE COUNT SELECT 3, PIN D] [MULTIRATE COUNT, PIN K][MULTIRATE V SYNC, PIN M]
B	COUNT 2	[MULTIRATE COUNT SELECT 2, PIN M][MULTIRATE COUNT SELECT 3, PIN C] [MULTIRATE COUNT, PIN F][MULTIRATE V SYNC, PIN L]
A	*0.5 CONTROL	[CONTROL PANEL]

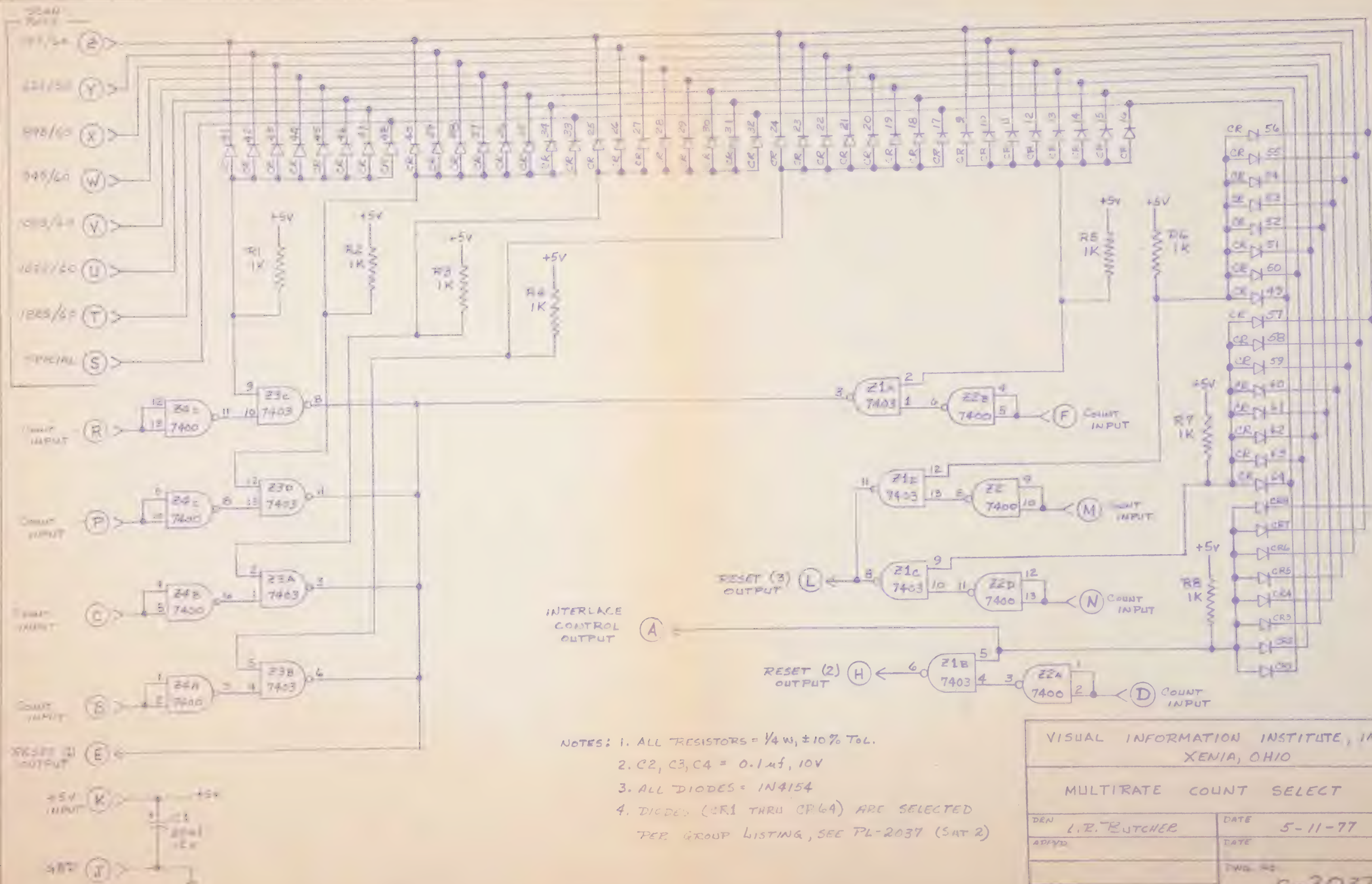
*This connection made only if 1:1 interlace option is included in instrument.

WIRING INTERCONNECTIONS

CONNECTOR PIN	FUNCTION	DESTINATION
Z	525	[MULTIRATE COUNT SELECT 2, PIN Z][MULTIRATE COUNT SELECT 1, PIN Z] [CONTROL PANEL, S1, SCAN RATE SELECT]
Y	625	[MULTIRATE COUNT SELECT 2, PIN Y][MULTIRATE COUNT SELECT 1, PIN Y] [CONTROL PANEL, S1, SCAN RATE SELECT]
X	875	[MULTIRATE COUNT SELECT 2, PIN X][MULTIRATE COUNT SELECT 1, PIN X] [CONTROL PANEL, S1, SCAN RATE SELECT]
W	945	[MULTIRATE COUNT SELECT 2, PIN W][MULTIRATE COUNT SELECT 1, PIN W] [CONTROL PANEL, S1, SCAN RATE SELECT]
V	1023	[MULTIRATE COUNT SELECT 2, PIN V][MULTIRATE COUNT SELECT 1, PIN V] [CONTROL PANEL, S1, SCAN RATE SELECT]
U	1029	[MULTIRATE COUNT SELECT 2, PIN U][MULTIRATE COUNT SELECT 1, PIN U] [CONTROL PANEL, S1, SCAN RATE SELECT]
T	1225	[MULTIRATE COUNT SELECT 2, PIN T][MULTIRATE COUNT SELECT 1, PIN T] [CONTROL PANEL, S1, SCAN RATE SELECT]
S	SPECIAL	[MULTIRATE COUNT SELECT 2, PIN S][MULTIRATE COUNT SELECT 1, PIN S] [CONTROL PANEL, S1, SCAN RATE SELECT]
R	COUNT 8	[MULTIRATE COUNT SELECT 2, PIN P][MULTIRATE COUNT SELECT 1, PIN C] [MULTIRATE COUNT, PIN B][MULTIRATE V SYNC, PIN N]
P	COUNT 16	[MULTIRATE COUNT SELECT 3, PIN N][MULTIRATE COUNT SELECT 1, PIN D] [MULTIRATE COUNT, PIN A]
N	COUNT 16	[MULTIRATE COUNT SELECT 3, PIN P][MULTIRATE COUNT, PIN A][MULTIRATE COUNT SELECT 1, PIN D]
M	COUNT 32	[MULTIRATE COUNT SELECT 1, PIN F][MULTIRATE COUNT, PIN B]
L	RESET 2	[MULTIRATE COUNT SELECT 2, PIN E][MULTIRATE BLANK/CONTROL, PIN S]
K	+5v.	[+5v. BUSS]
J	GROUND	[GROUND BUSS]
H	RESET 1	[MULTIRATE COUNT SELECT 3, PIN E][MULTIRATE BLANK/CONTROL, PIN T]
F	COUNT 0.5	[MULTIRATE COUNT SELECT 2, PIN D, PIN F][MULTIRATE COUNT, PIN L]
E	RESET 5	[MULTIRATE COUNT SELECT 3, PIN H][MULTIRATE BLANK/CONTROL, PIN T]

WIRING INTERCONNECTIONS

CONNECTOR PIN	FUNCTION	DESTINATION
D	COUNT 1	[MULTIRATE COUNT SELECT 2, PIN C, PIN N][MULTIRATE V SYNC, PIN M] [MULTIRATE COUNT, PIN K]
C	COUNT 2	[MULTIRATE COUNT SELECT 2, PIN B, PIN M][MULTIRATE COUNT, PIN F] [MULTIRATE V SYNC, PIN L]
B	COUNT 4	[MULTIRATE COUNT SELECT 2, PIN R][MULTIRATE COUNT SELECT 1, PIN B] [MULTIRATE COUNT, PIN E][MULTIRATE V SYNC, PIN K]
A	--	



525/60

625/50

875/60

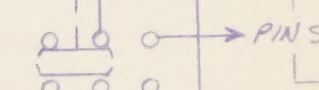
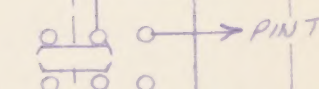
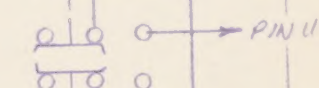
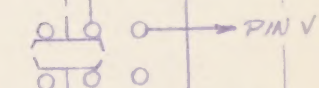
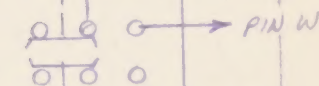
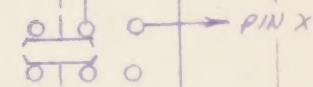
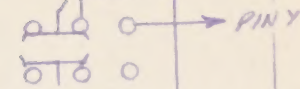
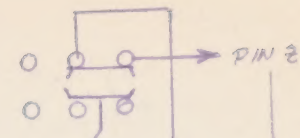
945/60

1023/60

1029/60

1225/60

SPECIAL
(779/60)



MULTIRATE COUNT
SELECT - 1

GRD -
PULSE OUTPUT

S1
SCAN RATE
SELECTION

PIN H
V SYNC

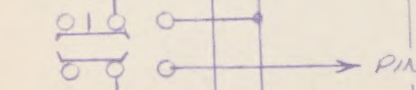
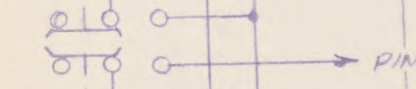
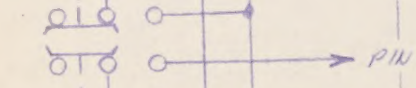
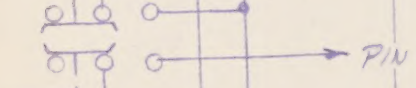
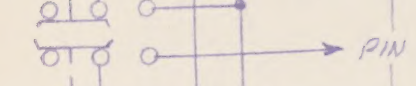
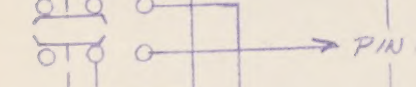
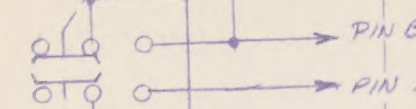
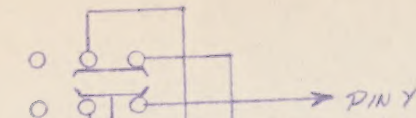
S2
SYNC
WAVEFORM
MODE

BROADCAST

MILITARY

INDUSTRIAL

PIN E
V SYNC



MULTIRATE CRYSTAL

PIN F
PULSE
OUTPUT
(+5v.)

PIN C
MULTIRATE
DUAL MONO
2H FRONT PORCH
& H SYNC

NOTE: SWITCH S1, SCAN RATE SELECT,
SHOWN IN 525/60 POSITION.

VISUAL INFORMATION INSTITUTE, INC.
XENIA, OHIO

SYNC SOURCE 1303
CONTROL PANEL WIRING

DRN

DATE 3-10-78

DWG NO.

S-3014

